VIBRATION TEST EQUIPMENT

VIBRATION CONTROL SYSTEM

MODEL 400AT/S

SINUSOIDAL VIBRATION TESTING

UNHOLTZ-DICKIE CORPORATION

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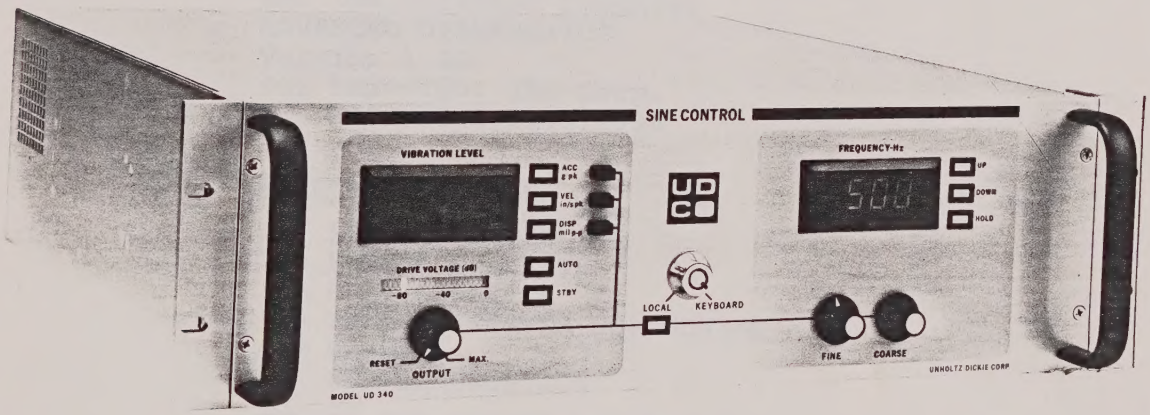
SINUSOIDAL VIBRATION TESTING

The Heart of the 400AT/S Vibration Control System



Model UD340 Sine Control

3/9/87

IMPORTANT

PARK THE HEAD OF THE FIXED DISK BEFORE MOVING THE SYSTEM TO PREVENT DAMAGE TO THE HARD DISK.

1) Insert the IBM diagnostics diskette.
2) Turn PC AT AC power OFF, then back ON.
3) After approximately thirty seconds the following appears on the CRT screen.

```
The IBM Personal Computer
ADVANCED DIAGNOSTICS
Version 1.02
(C) Copyright IBM Corp.
    1981,1982,1983,1984

SELECT AN OPTION

0 - SYSTEM CHECKOUT
1 - FORMAT DISKETTE
2 - COPY DISKETTE
3 - PREPARE SYSTEM FOR MOVING
4 - SETUP
9 - END DIAGNOSTICS

SELECT THE ACTION DESIRED
?
```

4) Type "3" then "Enter"
5) The following appears on the CRT screen when operation is complete.

```
DRIVE C
IS PREPARED FOR MOVING
TURN SYSTEM OFF
?
```

6) Remove diagnostic diskette and turn power OFF.
   Insert the protective cardboard diskette.

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TABLE OF CONTENTS

Chapter	Subject
1	SYSTEM OVERVIEW AND THEORY OF OPERATION
2	INSTALLATION - INTERCONNECTIONS
3	PRELIMINARY SYSTEM OPERATION - SINE VIBRATION TESTING
4	PERFORMING THE SINE VIBRATION TEST
5	SAVING AND RETRIEVING DATA
6	COPYING OPERATIONS
7	CHECKOUT - CALIBRATION
8	CIRCUIT SCHEMATICS - LAYOUTS
9	CIRCUIT DESCRIPTION

1. SYSTEM OVERVIEW AND THEORY OF OPERATION

1.1 General System Description and Objectives

The UD Model 400AT/S Vibration Control System (VCS) is used in conjunction with a vibration test system (VTS), consisting of a power amplifier, test specimen, accelerometers and signal conditioners. For swept-sinusoidal vibration testing, it provides computer control for the signal generation, level regulation measurement and documentation necessary to perform a complete test.

The 400AT/S provides the means to:

1 - Specify the various test parameters and to initiate the test through keyboard entry.

2 - Acquire the accelerometer input signal(s) from the charge amplifier(s).

3 - Execute the test in a completely automatic mode which may be overridden.

4 - Monitor the test by means of real-time test graph displays and status messages.

5 - Perform error checking and provide quick and transient-free shutdown when abort conditions exist.

6 - Allow additional channels for average control and/or independent channel frequency response analysis.

7 - Store and provide hard copy for test setup parameters and test data.

8 - Allow means for remote control (optional).

1.2 System Configuration

The block diagram of the UD Model 400AT/S in conjunction with a typical vibration test system is shown in Figure 1-1. The VCS consists of a System Host with a MetraByte DASCON 1 Card and the UD340 SINE CONTROL. Commands and data flow between the DASCON 1 in the System Host and the UD340. The System Host also provides an external interface for remote control of the VCS.

The UD340 provides the drive voltage for the power amplifier. When the average control option is supplied, it accepts as many as eight input signals which represent the accelerations at various points on the test specimen. All eight inputs may be selectively multiplexed for average control. Also, any one of the eight inputs, regardless of its use as a control input, may be selected for analysis purposes only.

The simplest configuration for the UD340 provides one input for control use only. The analysis option provides a single input for control purposes and an additional input for analysis only.

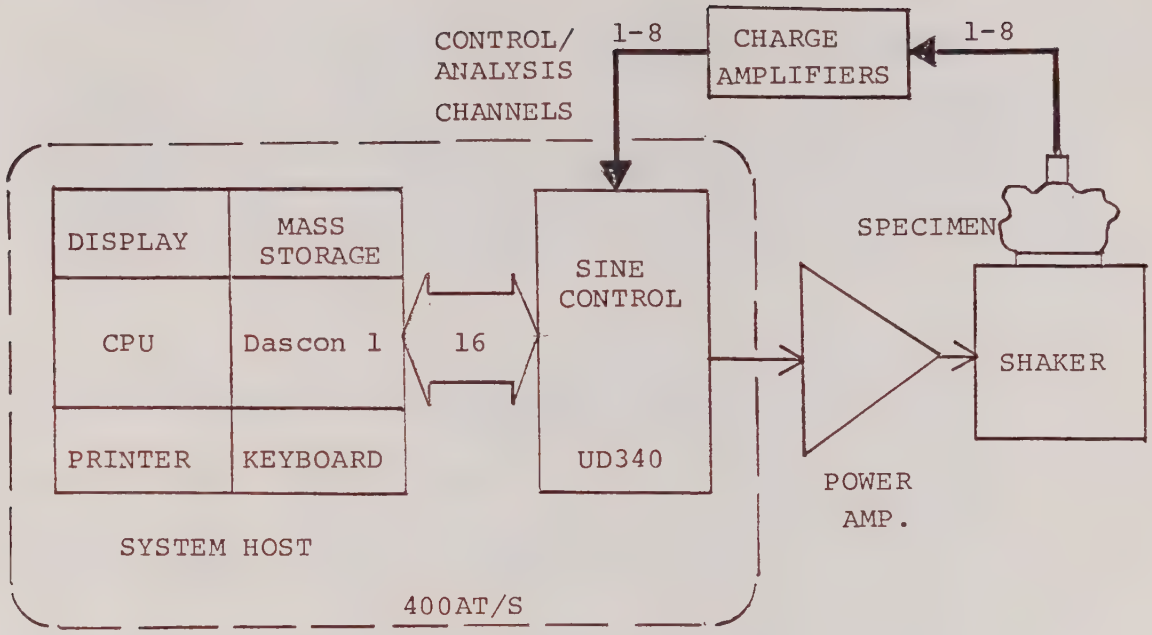


Fig. 1-1
Block Diagram - Vibration Test System with 400AT/S

1.3 UD340 Signal Flow

Figure 1-2 shows further details of signal flow associated with the UD340. The eight possible control/analysis inputs are shown, along with the drive voltage output from the UD340.

The UD340 has four major sections: the sweep oscillator, the automatic gain control (AGC) amplifier, the vibration level programmer and the digital interface for control from the System Host Computer.

The sweep oscillator section digitally generates a constant amplitude sine wave with extremely low harmonic distortion. The frequency may be swept up and down, over any portion of the three-decade frequency range, in a linear or logarithmic fashion, over a wide range of sweep speeds and for a specified number of times. The sinusoidal oscillator signal is the input to the AGC amplifier.

The vibration level programmer section accepts the acceleration input signal(s). A multiplexer provides a composite signal containing one cycle of each input signal in the sequence specified by the operator. The multiplexed signal is used for acceleration

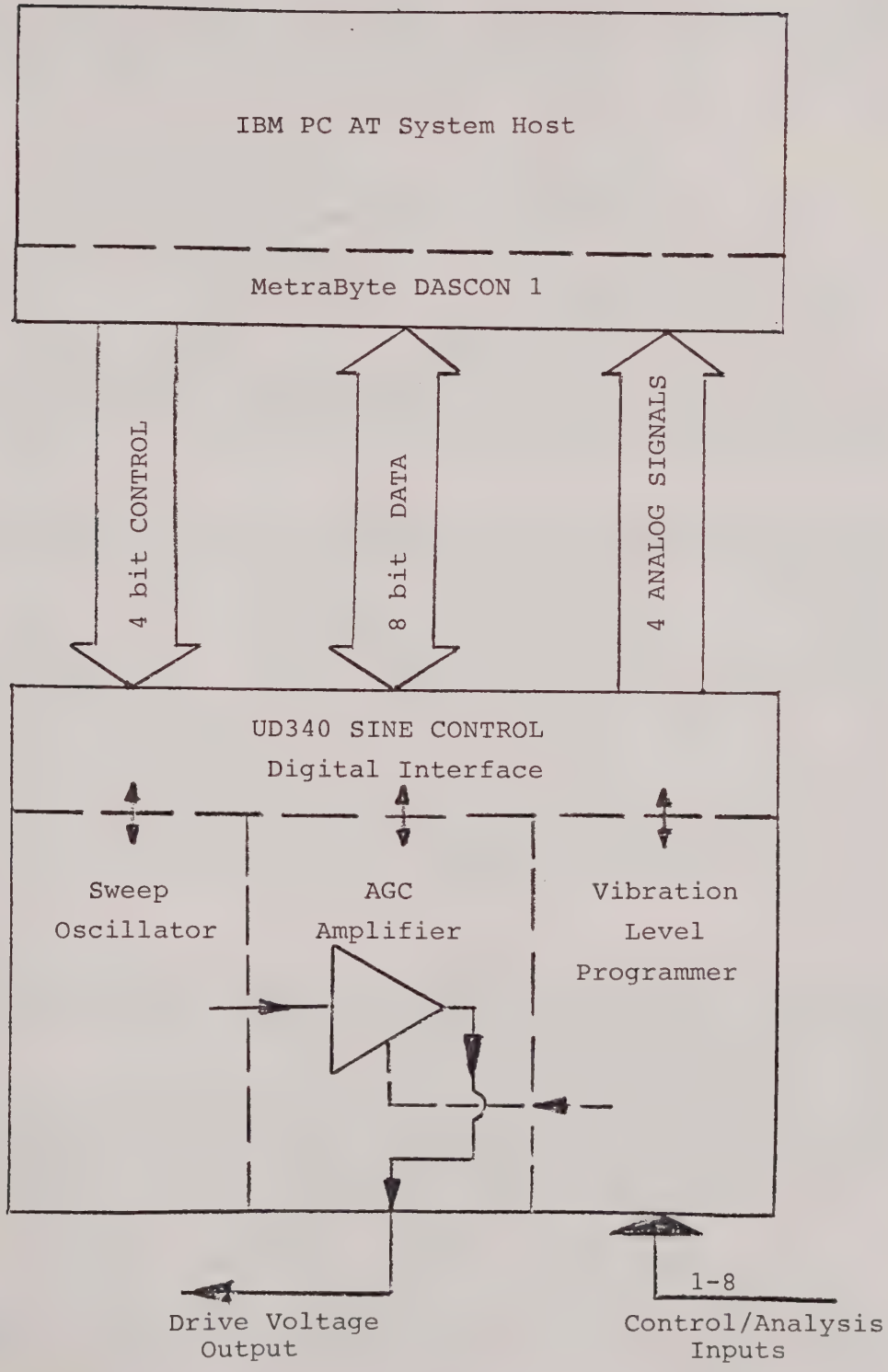


Fig. 1-2 Signal Flow - UD340 with Host

control segments only, and the first channel specified in the input sequence is used for displacement and velocity control segments.

The programmer can define a control reference for any combination of as many as 60 constant acceleration, velocity and displacement segments with the crossover frequencies being automatically calculated or operator selectable. Reference control levels are possible over the following intervals:

Acceleration:	0.1 to 1000 g - peak
Velocity:	0.1 to 1000 in/s peak
Displacement:	1 mil to 10 in pk - pk

Due to system noise levels, the lower velocity and displacement levels may not be possible at low frequencies.

In providing for the specified control reference segment, the programmer integrates the control signal once for constant velocity segment, and twice for a constant displacement segment. The overall signal level is adjusted to provide the specified control amplitude.

The UD340 also contains a charge amplifier for conditioning one accelerometer signal. The charge sensitivity is manually set by two rear panel controls to provide a conditioned output signal at 10 mV/g.

The AGC amplifier provides a variable gain amplifier for the signal output from the oscillator section. The output from the AGC amplifier is the drive signal for the power amplifier. The AGC amplifier also accepts the modified control signal from the programmer section. The amplitude of the control signal is obtained from an AC-DC converter, the detection speed of which is a controlled function of frequency. The control amplitude is then compared with a fixed reference and any difference causes the gain of the AGC amplifier to change the drive signal level so that the difference of the control signal amplitude and the reference goes to zero.

The detection speed or compressor speed of the AGC amplifier increases with frequency and is selected by the operator. The AGC amplifier also has unique circuitry which provides a drive signal with extremely low harmonic distortion.

The digital control section for the UD340 contains the necessary registers, FET switches and multiplying DACs to provide the functions described previously. Two digital busses provide communication between the Host and the UD340:

CONTROL Bus (4-bit)--- DASCON 1 to UD340
DATA Bus (8-bit)------ Bidirectional

In addition, four analog signals are fed from the UD340 to the DASCON 1 card. They represent operating frequency, control channel vibration level, analysis channel vibration level and drive voltage.

The CONTROL bus provides the following functions for the UD340.

1 - Strobes the address for the various registers.

2 - Initiates crossover from one control segment to the next.

3 - Writes data on the DATA bus.

4 - Reads data on the DATA bus.

The DATA bus provides the following functions:

1 - Sets the significant bits, full-scale range and A-V-D selection for the UD340 reference level.

2 - Sets the sweep rate and selects the sweep type (log or lin.).

3 - Sets the multiplexer channel sequence.

4 - Sets the channel number and the acceleration full scale range for analysis.

5 - Sets the STATUS (operational mode) of the UD340. These include LOCAL or KEYBOARD control, AUTO (closed-loop) control, MANUAL (closed-loop) control, and STANDBY (zero signal) for the AGC amplifier section. SWEEP DIRECTION (up/down), and HOLD (frequency) are set for the oscillator section. The CAL mode automatically disconnects the drive voltage from the power amplifier and feeds it directly to the acceleration input, thus bypassing the VTS.

6 - Reads the STATUS described above.

7 - Reads acceleration full scale range for LOCAL mode operation.

1.4 System Host

An IBM Personal Computer AT Enhanced Machine, based around the 80286 Microprocessor is the System Host. It includes a 30 Mbyte hard disk, a 1.2 Mbyte floppy disk, a 512 Kbyte RAM, a MetraByte DASCON 1 data acquisition and control interface card, a high resolution color display and graphic interface, a 80287 math coprocessor, a dot-matrix printer, a clock calendar with battery back-up, a keyboard and the DOS operating system. Primarily the System Host is used to set up, initiate and monitor tests, and also to record and to provide hard copy of test results.

The operator enters the test parameters by means of the keyboard at the System Host in response to a series of simple menus and prompts. The System Host boots directly to the vibration test menu when AC power is applied.

For monitoring tests in progress, the System Host provides continually-updated, fully-annotated, high-quality color graphic displays of the following variables, as functions of frequency.

1 - Control acceleration, reference acceleration and abort limits

2 - Analysis channel acceleration

3 - Drive voltage

4 - Transfer ratio of analysis channel acceleration to control channel acceleration.

Appropriate messages and measurements are also displayed on the borders of the graphical displays. These include peak acceleration, peak velocity, peak-to-peak displacement, frequency, current reference level, duration of the test, time of day, date, maximum compressor speed, test status, sweep number, sweep type, and input channel sequence.

Single keystroke commands allow the System Host to select and control various test modes. The test variable being displayed and the configuration of the test graphs are also controlled mostly by single keystroke commands.

The hard disk provides storage for hundreds of test setups amd data from hundreds of test runs. Backup and archiving is accomplished with floppy disks.

The high-speed graphics printer provides hard copy of test setups and graphs of test data. The test setups are suitably organized in tabular form for the reference segments and their associated abort limits. The graphs of test data are rotated 90° when printed to provide the same aspect ratio on the 8 1/2 x 11 sheet as is attained on the color monitor, thus maximizing the size of the hard copy graphs.

An optional communications interface is available to provide overall system control from a remote host. Rudimentary commands to start, stop, select a test setup and test mode, and to request status are implemented.

The System Host, aside from the specific function of test control, may also act as a general purpose computer to run any IBM PC AT software and to allow for development of user-specified programs.

1.5 Technical Specifications (UD340 with IBM PC AT Host)

FREQUENCY RANGE	- 5 to 5000 Hz Stability $\pm$1% or 0.5 Hz, whichever is larger
SWEEP TYPE	- Logarithmic or linear

MAX SWEEP RATE - 10 octaves/min for log sweep
5000 Hz/min for linear sweep
Minimum Sweep Time, 1 minute

SWEEP REVERSAL LIMITS- Selectable over entire frequency range

NUMBER OF SWEEPS - 1 to 9999 or continuous

STARTING FREQUENCY - Selectable over entire frequency range

COMPRESSOR SPEED - Automatically controlled as a continuous function of frequency from 10 dB/sec at 5 Hz to a selectable maximum of 100, 300, 1000 or 3000 dB/sec at 5 kHz

DYNAMIC GAIN RANGE - Greater than 80 dB

CORRECTION ACCURACY - Essentially zero static error. 70 dB gain change results in less than 0.1 dB change in test level

REFERENCE - Defined using any combination of up to 60 constant acceleration, velocity and displacement segments. Crossover frequencies automatically calculated or operator selectable.

ABORT LIMITS - Independently settable upper and lower limit in percent for each segment

CONTROL STRATEGY - Single channel peak control standard. Eight channel averaging (optional). Internally multiplexed according to sequence specified. Average control for acceleration segments only.

DRIVE VOLTAGE - 9V rms max. Harmonic distortion less than 0.3% from 20-3000 Hz; less than 0.5% from 5-5000 Hz. Output impedance 50 ohm.

ACCELERATION INPUT(S) - 10 mV/g conditioned input - At least 47 kilohm input impedance; charge input adjustable from 1-100 pc/g input sensitivity.

TEST STORAGE

Setups - Tests are specified through use of prompts and selection menus. Storage is provided for hundreds of test setups on the hard disk.

Test Data - Test spectra (fully annotated) are stored automatically or as selected by the operator. Storage is provided for hundreds of test spectra. Spectra stored include the control, reference, abort limits, drive, analysis channel (optional) and transmissibility ratio (optional).

2. INSTALLATION - INTERCONNECTIONS

2.1 Preliminary

Unpack the separate items carefully, taking care not to damage any items or lose any small items. It would be advantageous to save the shipping containers should any items need to be shipped to the factory during the warranty period.

The following items should be available after unpacking:

1 - U-D Model UD340 SINE CONTROL
2 - IBM PC AT Enhanced (5170) - Host Computer with Metrabyte Dascon 1 Interface
3 - Keyboard for Host Computer
4 - IBM Model 5154 Video Monitor - Enhanced Color Display
5 - Okidata Microline 192 - Matrix Printer
or
Star 56-10, or Delta 15 plus, Matrix Printer
6 - Signal cable for printer (25 pin D - connectors)
7 - 37 pin Signal Cable
8 - Removable power cords for the Host Computer, Video Monitor, and Okidata printer
9 - Mounting Cabinet (optional)

Before making electrical connections, arrange the various items in the Mounting Cabinet. The printer is placed in the sound-proofed upper compartment. The Host Computer is placed on the shelf below the upper compartment, and the Video Monitor, on top of the Host. The keyboard is placed on the desk top which moves in and out of the cabinet just below the Host Computer. Finally, the UD340 SINE CONTROL can be placed on the bottom level of the mounting cabinet, or with the use of the accessory rack mounting ears, to be mounted inside the system console, which houses the power amplifier, field supply and other controls. The UD320 High Speed Digital Signal Processor may also be placed on the bottom shelf of the mounting cabinet if Random Control or Shock Synthesis has also been supplied.

2.2 Power Connections

Arrange to apply line power to the UD340, Host Computer, Video Monitor and Matrix Printer. Use the line power receptacle (115 VAC) mounted inside the Mounting Cabinet. The user may want to purchase and install a power line surge protector at this point.

The user may also desire to apply power to the 400AT through the vibration power amplifier console, by plugging the line power cord from the common receptacles inside the Mounting Cabinet to a line power receptacle inside the UD system console. This allows line power to be applied when the POWER ON button is pushed on the Power Amplifier Control Panel. This step should be done last, however, as a number of signal interconnections still have to be made.

Check the line voltage switches on the rear panels of the UD340 and the Host Computer, and also the specifications on the rear panels of the printer and Video Monitor to make sure that they agree with the line voltage being supplied (usually 105-125 VAC 50-60 Hz).

2.2 Signal Interconnections - Host Computer

Make the following signal interconnections:

1. The keyboard is connected to the Host Computer via a cable with a 5 pin circular connector and a mating connection on the rear of the Host Computer. When the pins are appropriately mated, push the connector in about 1/2 inch.

2. The Host Computer is connected to the UD340 SINE CONTROL via the cable with a 37 pin D-style female connector on each end. The port on the rear panel of the UD340 is labeled J1 and the corresponding port on the rear of the Host Computer is in connector slot 7. Tighten the two locking screws on each connector housing after mating.

3. The integral signal cable on the Video Monitor has a 9 pin male D style connector which mates to the connector in slot 1 on the rear of the Host Computer. Tighten the locking screws with a small screwdriver.

4. The printer cable may or may not be integral with the printer, depending on the printer model. The 25 pin male D style connector mates with the connector in slot 5 on the rear of the Host Computer. Tighten the locking screws with a small screwdriver.

5. If the option for Random Vibration Testing has been included, the IEEE 488 port in slot 4 on the rear of the Host Computer is reserved for the cable to the UD320 HSDSP.

2.3 Signal Interconnections - UD340 SINE CONTROL

Refer to Fig. 2-1 which shows the rear panel of the UD340 SINE CONTROL. Near the middle of the panel are the eight acceleration input connections of the 400AT/S System, when the average control option is supplied.

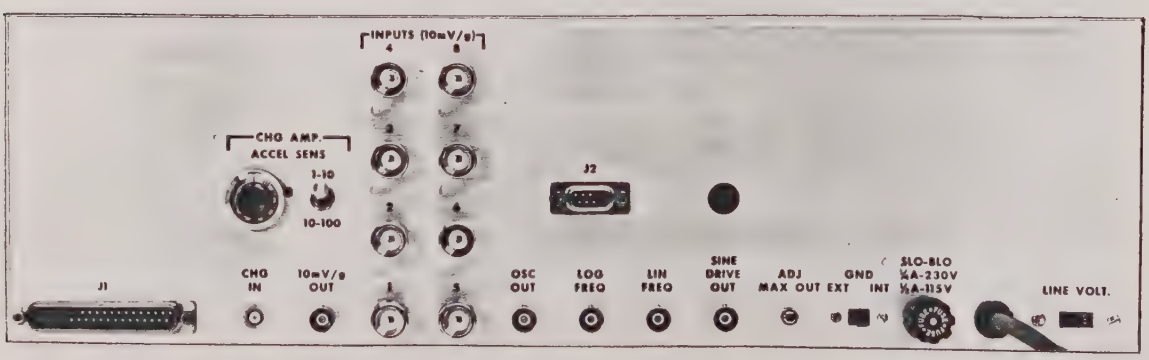


Fig. 2-1 Rear Panel - Model UD340 SINE CONTROL

The eight insulated BNC connectors near the center of the rear panel accept input signals from external (acceleration) signal conditions at a sensitivity of 10 mV/g. Those BNC connectors not connected via coaxial cable to signal conditioners must have the associated shorting caps seated securely over the unused connectors.

One internal charge amplifier is supplied with the UD340. It will accept a signal input through a noise-treated coaxial cable from a piezoelectric accelerometer at the miniature 10-32 CHG IN connector. The accelerometer sensitivity in pC/g is set on the potentiometer and range switch above the CHG IN connector. The 10 mV/g OUT connector then supplies a conditioned signal at the standardized sensitivity.

The 10 mV/g OUT signal may be connected externally to one of the INPUT connectors. (Usually Channel 1 for the control input.)

Connect the signal from DRIVE OUT to the input connector of the power amplifier via a coaxial cable with BNC connectors.

The OSC OUT and LIN FREQ signals are used if tracking filters (UD Model TF22) are necessary to filter the 10 mV/g acceleration input signals.

As explained previously, J1 is used for a cable connection to the Host Computer with the Metrabyte Dascon 1 interface card.

2.4 Final Check

Check to make sure that all connections are properly made between the Host Computer, Printer, Keyboard, Video Monitor and the UD340. Then make sure that connections have been made between the control accelerometers, signal conditioners (if necessary) and the UD340, and also between the UD340 and the power amplifier. All power cords should be inserted into outlet boxes. Finally, the power cord from the Mounting Cabinet for the Host Computer should be connected to an outlet strip inside the system console.

At this point you can begin Chapter 3. A.C. power to the Mounting Console can be turned on by pressing the PREAMP ON button for the UD System Console. Heed the following warning.

WARNING

It should be noted that power to the UD340 SINE CONTROL should not be applied or removed when the power amplifier is turned on and the gain is turned up. With the power cords connected as suggested earlier, this should not be possible.

3. PRELIMINARY SYSTEM OPERATION SINE VIBRATION TESTING

3.1 Introduction

The U-D Model 400AT/S is extremely user-friendly, being extensively driven by responses to menus and requests appearing on the screen of the color monitor. All responses are entered on the keyboard of the host computer. In this chapter the operator is taken on a guided tour through the various menus and test description procedures. Practically all of the procedures need little additional description because operator requests for help cause explanative text to be displayed on the color monitor.

3.2 Initial Procedure

Make sure that the installation procedures described in Chapter 2 have been completed successfully. Actually, it is not necessary at this time that the system power amplifier be turned on, since all procedures in this chapter stop short of initiating a drive signal to the power amplifier from the UD340 SINE CONTROL.

Turn the monitor on by turning the upper knob clockwise. The middle knob adjusts the background level of test graphs displayed on the monitor. The lower knob adjusts the brightness of the display.

Turn on the line printer power switch. Make sure the SELECT indicator is lighted. Press the SELECT button if it is not. Turn on the power switch of the host computer and make sure that the UD340 has power applied.

The host computer proceeds through some initial internal checks and in less than a minute, the system logo is automatically displayed on the monitor, a copy of which is shown on p. 3-3. The guided tour is almost ready to begin.

3.3 System Keyboard

The system keyboard is pictured below in Fig. 3-1. The left hand block of 10 keys, (F1) through (F10), are called FUNCTION KEYS. These keys are used to make entries from system menus, and to control system operation when the vibration test is actually in progress.

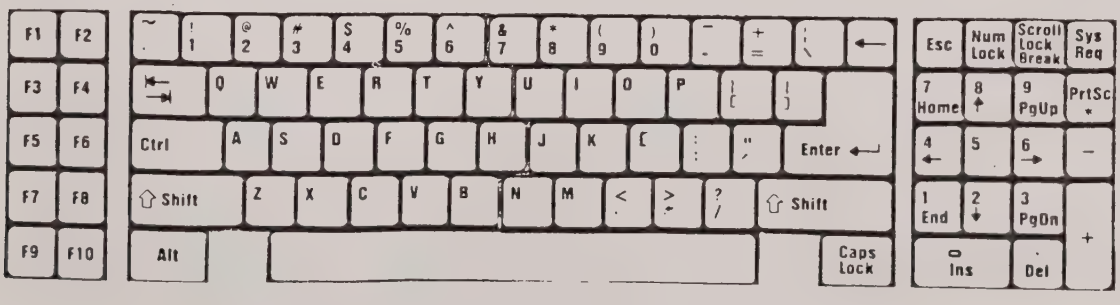


Fig. 3-1 System Keyboard

The central block of 56 keys contains the standard typewriter keyboard as well as three special purpose keys: (Ctrl)-control, (Alt)-alternate; (Enter). The (Enter) key is most frequently used to confirm responses to queries appearing on the monitor, after the operator has had a chance to view the entry. Numerical entries are most conveniently done from this keyboard since they are all lowercase.

The right hand block of 18 keys contains the CONTROL KEYS commonly used in the 400AT. They are (Esc)-escape; (End); (Ins)-insert; (Del)-delete; (PgDn)-page down; (PgUp)-page up; (PrtSc)-print screen, and the four cursor movement arrows. These are all lowercase, except for (PrtSc) which requires simultaneous application of (Shift). Numerical entries from this keyboard are all uppercase, and are not recommended, since an error can easily cause a control key command.

3.4 Important Special Commands

The (Shift, PrtSc) command causes the line printer to print text only appearing on the screen. It may not be used to print graphical displays introduced in the following chapters. The (Shift, PrtSc) command was used to copy the monitor displays shown on the following pages.

Should any unusual action result in a situation for which the FUNCTION and CONTROL keys seem to be inoperative, press (Ctrl, Alt, Del) simultaneously. This will cause the monitor to go blank, and the host will repeat its initial self-checking action, with the System Logo on p. 3-3 reappearing.

YOU SHOULD NOW BE READY TO START THE PRELIMINARY GUIDED TOUR OF THE 400AT/S. Start on p. 3-3. Note that many of the procedures are similar or nearly identical to those for the 400AT/R RANDOM VIBRATION CONTROL SYSTEM.

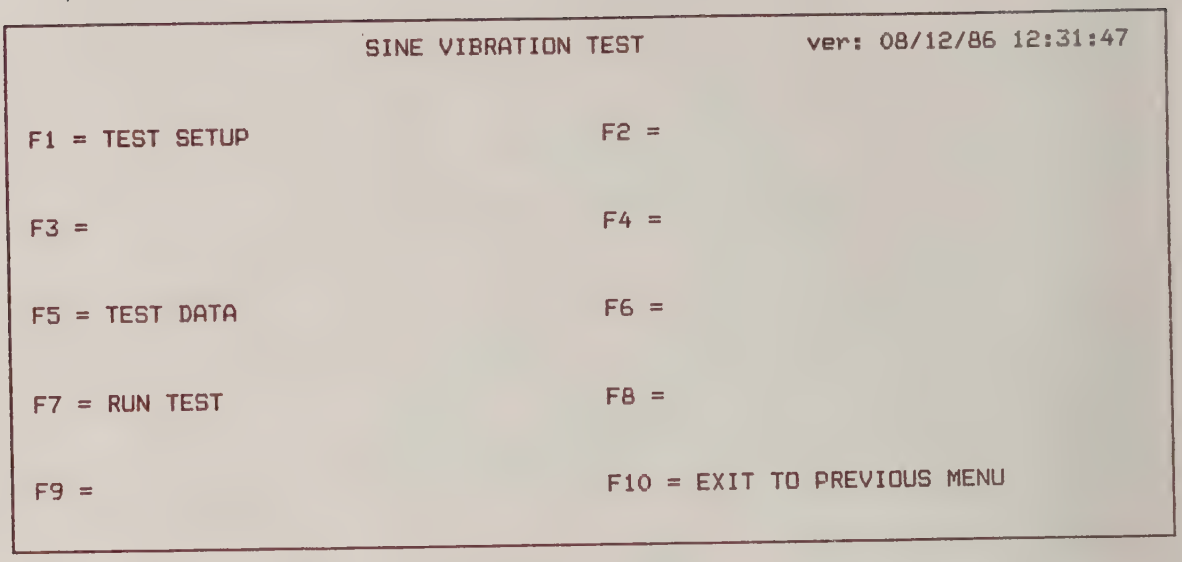
Following successful completion of Section 3.2, the System Logo is displayed on the monitor:

```
                        UNHOLTZ-DICKIE



                        MODEL  400AT

                DIGITAL VIBRATION CONTROL SYSTEM

     You may use the Model 400AT Digital Vibration Controller host software
and the UD320 Signal Processing software, as well as, all associated printed
materials under the terms of the UNHOLTZ-DICKIE Program License Agreement.
In summary UNHOLTZ-DICKIE grants you, as part of the price you paid for
this product, a non-transferrable personal license to use the standard system
software package (and options purchased) on a single Model 400AT unit.
You do not become the owner of the system software package nor do you have
the right to copy, transmit, or alter the software or the related printed
materials. You are legally accountable for any violation of the License
Agreement and Copyright laws.
                Copyright (c) 1986 by Unholtz-Dickie Corp
ver 3.00s    09/11/86       16:28:07
PRESS any KEY to ASSENT to the License Agreement and proceed with the program
```

Pressing any key displays the MAJOR OPERATIONAL MODES Menu below:

```
                    MAJOR OPERATIONAL MODES

F1 = RANDOM TEST                    F2 = REMOTE/LOCAL

F3 = SINE TEST                      F4 = MEASUREMENT/ANALYZE

F5 = SINE ON RANDOM TEST            F6 = MAINTENANCE/DIAGNOSTICS

F7 = SHOCK TEST                     F8 = HELP

F9 = RANDOM ON RANDOM TEST          F10 = EXIT

SELECT A FUNCTION KEY
```

Press (F1) to display the SINE VIBRATION TEST Menu on p.3-4.
Selection of (F10) would display the System Logo again.



Press (Shift,?) simultaneously to obtain the HELP display shown on p.3-5. This offers further explanation of the FUNCTION KEYS.

Note that all possible CONTROL KEY selections are shown at the bottom of each display, as well as other instructions.

SINE VIBRATION TEST MENU

All key selections display new menus except F7.

F1 - TEST SETUP - A test setup is the specification and entry of all test parameters. This menu allows various operations with saved test setups as well as creation of new setups.

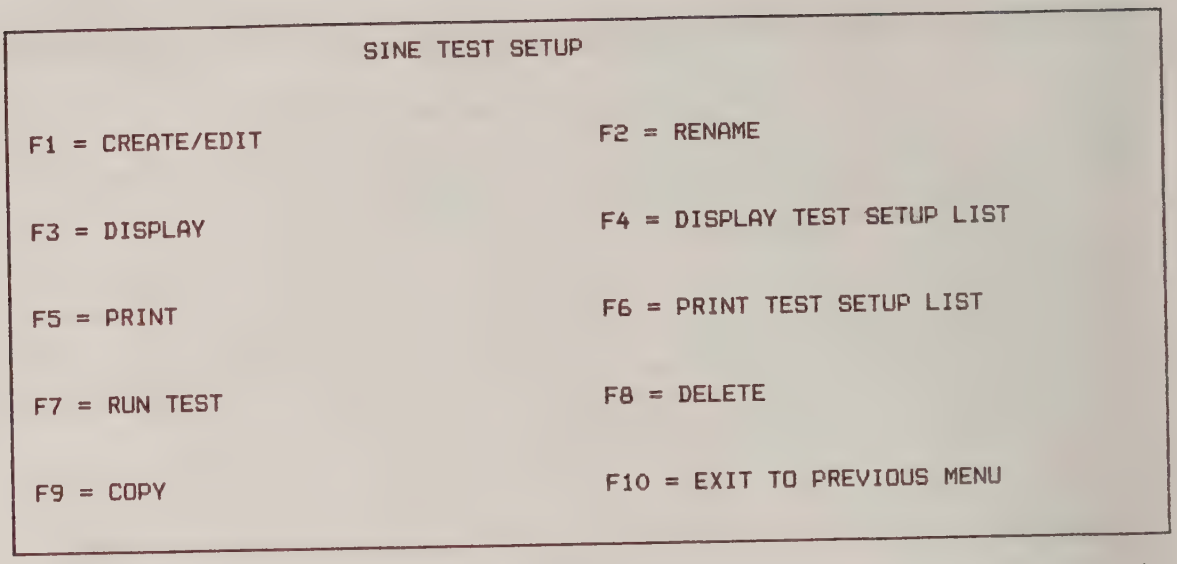
F5 - TEST DATA - Menu allows various operations with saved test data.

F7 - RUN TEST - Allows a test to be started. The first default entry is the most recently saved test setup. This entry may be overwritten with any other saved test setup ID. Two additional default entries may also be overwritten to initiate the test.

Esc - back to menu

Press (Esc) to return to SINE VIBRATION TEST Menu on p.3-4.

Press (F1) to display SINE TEST SETUP Menu on p.3-6.



Press (Shift,?) to obtain the HELP displays on p.3-7.

SINE TEST SETUP MENU

Default entry for F1,F3,F5 and F7 is the most recently saved test setup. It may be overwritten with another entry.

F1 - CREATE/EDIT - Creates a new setup or allows changes to an existing one.

F2 - RENAME - Changes the ID for an existing test setup to a new ID.

F3 - DISPLAY - Displays the setup parameters including a graph of the reference acceleration vs frequency. No changes can be made in this mode.

F4 - DISPLAY TEST SETUP LIST - Displays a list of all existing test setups sorted alphabetically, with the time and date that each was created or last updated.

F5 - PRINT - Prints the setup parameters for an existing test setup.

F6 - PRINT TEST SETUP LIST - Prints a list of all existing test setups sorted alphabetically, with the time and date that each was created or last updated.

PgDn - to continue Esc - back to menu

Press (PgDn) to display HELP (pg.2) below:

SINE TEST SETUP MENU (pg 2)

F7 - RUN TEST - Initiates the identified test. The remaining two default entries displayed may also be overwritten.

F8 - DELETE - Deletes the specified test setup from the hard disk

F9 - COPY - Makes a copy of an existing test setup with an new ID, and does not change the original setup and its ID.

PgUp - back up one screen Esc - back to menu

Press (Esc) to return to SINE TEST SETUP Menu on p.3-6.
Press (F10) to return to SINE TEST Menu on p.3-4.
Press (F5) to display SINE TEST DATA Menu on p.3-8 following:

SINE TEST DATA

F1 =

F2 =

F3 = DISPLAY TEST GRAPH

F4 = DISPLAY TEST RUN LIST

F5 =

F6 = PRINT TEST RUN LIST

F7 = DELETE RUN

F8 =

F9 =

F10 = EXIT TO PREVIOUS MENU

SELECT A FUNCTION KEY

?-Help

Press(Shift,?) to display the HELP page below:

SINE TEST DATA MENU

F3 - DISPLAY TEST GRAPH - Allows operator to view the graphs of acceleration vs frequency that were stored during a test run. The two default entries are the test setup ID and test run name for the most recently saved data. They may be overwritten.

F4 - DISPLAY TEST RUN LIST - Displays the list of test setups and run names associated with each setup. The date and time the setup was last edited and the date and time the data was stored is also displayed.

F6 - PRINT TEST RUN LIST - Prints the test run list information displayed by F4.

F7 - DELETE TEST DATA - Allows entry of the test setup ID and test run name to remove the corresponding stored data from the hard disk.

Esc - back to menu

Press (Esc) to return to SINE TEST DATA Menu above.
Press (F10) to return to SINE TEST Menu on p.3-4.
Press (F7) to obtain RUN TEST entries on p.3-9.

The S.V. TEST Menu remains, and the three default entries for the RUN TEST command appear below the Menu in the display below. If these three entries were satisfactory, the operator would press (Enter) three times to confirm the entries and thus begin the TEST RUN. The NAME of the TEST RUN is updated after each TEST RUN for which data is saved (i.e. from RUN27 to RUN28), so that it is frequently unnecessary to change the TEST RUN NAME.

At this point, however, follow the instructions below.

```
                        SINE VIBRATION TEST          ver: 08/12/86 12:31:47

F1 = TEST SETUP                          F2 =

F3 =                                     F4 =

F5 = TEST DATA                           F6 =

F7 = RUN TEST                            F8 =

F9 =                                     F10 = EXIT TO PREVIOUS MENU

RUN TEST SETUP-ID : DEMO
ENTER RUN NAME....: RUN1
SAVE TEST DATA?...: 3
     (1=FIRST SWEEP,2=ALL SWEEPS,3=NO)

     Esc (Back to Menu)      Enter (Accepts Entry)
```

The flashing cursor is under the first symbol of the TEST SETUP ID.

Press (Enter), and the cursor advances under the first symbol of the RUN NAME.

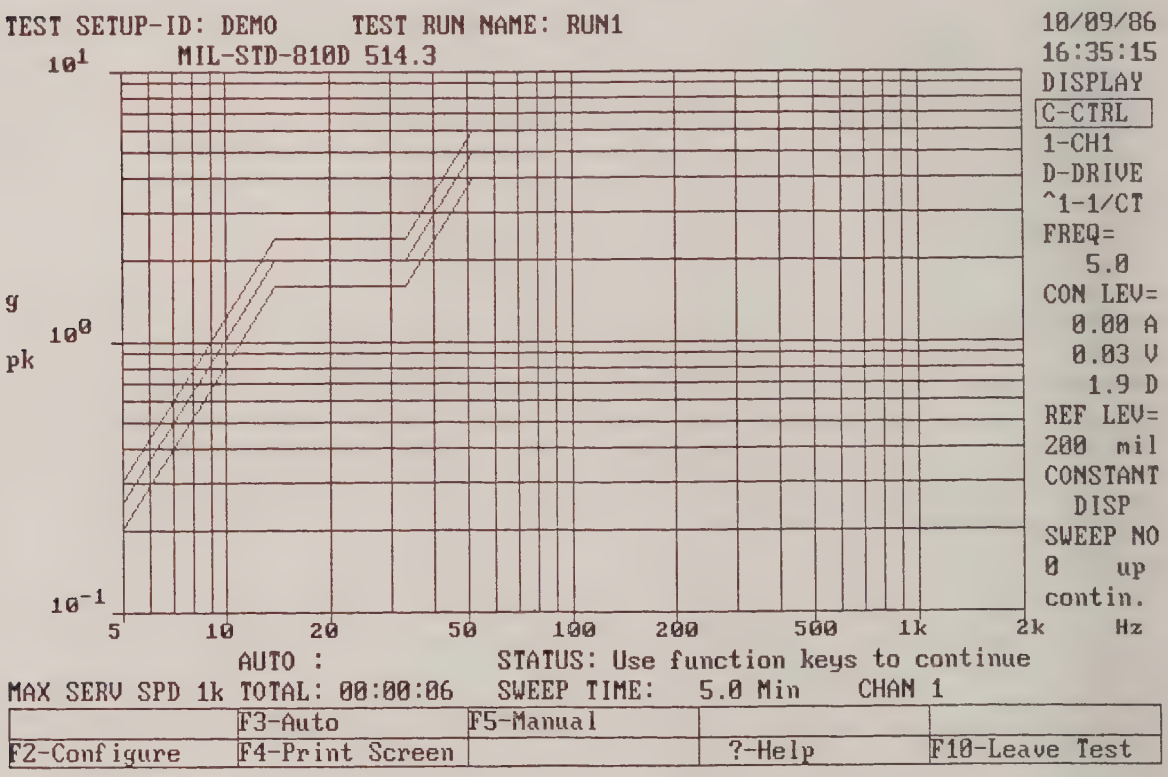
As a further comment at this time, no attempt is made to overwrite the default entry for the TEST SETUP ID because we have no way of knowing the ID's for other saved test setups. This apparent difficulty is solved later.

Press (Enter), and then overwrite the third entry with (2) from the central keyboard. Press (Enter), which causes the display on the following page to appear.

The display below shows a graph of the required acceleration vs frequency for the sine test DEMO. The abort limits are also indicated. The copy below is reduced in size from the actual color monitor display and the printer copy obtained by pressing (F4). Other test information is shown on the borders of the graph.

At this time we will not proceed further with the test, before we examine the details of the SINE TEST SETUP on the following pages.

Note that it is not really necessary to have the U-D340 SINE CONTROL connected to the host computer to proceeed through Chapter 3.



If the U-D 340 were not connected to the host computer, the STATUS message would have read, "UD340 Interface Failure".

Press (F10) to leave the test, and return to the S.V. TEST Menu on p. 3-4.

Press (F1) and the SINE TEST SETUP Menu on p. 3-6 appears.

Proceed to p. 3-11.

Press (F1), causing the default entry for the TEST SETUP ID to appear below the Menu.

```
                        SINE TEST SETUP

F1 = CREATE/EDIT                        F2 = RENAME

F3 = DISPLAY                            F4 = DISPLAY TEST SETUP LIST

F5 = PRINT                              F6 = PRINT TEST SETUP LIST

F7 = RUN TEST                           F8 = DELETE

F9 = COPY                               F10 = EXIT TO PREVIOUS MENU
```

```
CREATE/EDIT TEST SETUP-ID : DEMO

ROOM AVAILABLE ON DISK FOR 4205 TEST SETUPS
     Esc (Back to Menu)      Enter (Accepts Entry)
```

We are going to examine the parameters necessary to describe a TEST SETUP, and the means for entering them and changing them.

As a further commentary on the procedure followed on pp.3-11 and 3-12, note that the (F7)=RUN TEST choice again appears on the Menu above. However, we now have a means to determine TEST SETUP ID's other than the default entry by pressing (F4) or (F6).

Return to the display above. The flashing cursor is under the first symbol of the default entry. We now have three choices:

1- To create a new TEST SETUP, type a new ID (8 symbols or less).
2- To examine and possibly edit another saved TEST SETUP, type the corresponding ID.
3- To examine and possibly edit the last saved TEST SETUP, do not change the default entry.

We will follow the third choice.

Press (Enter), and the first page of line items for specifying the selected test setup is displayed as shown on p.3-12.

If a new TEST SETUP is being created, many line items have default entries to speed the setup process. These may be overwritten.

The flashing cursor appears below the first symbol for the TEST DESCRIPTION. Practice moving the cursor with the directional CONTROL KEYS. See HELP (pg.3) on p.3-13.

```
                        SINE TEST SETUP

TEST SETUP ID : DEMO                    LAST CHANGED: 09/30/86   10:44:58

TEST DESCRIPTION : MIL-STD 810D 514.3

SWEEP TYPE : ..................)1
    (1=LOG,2=LINEAR)

NUMBER OF SWEEPS : ............)20
    (0=CONTINUOUS,1 to 9999)

MAXIMUM SERVO SPEED : .........)3
    (1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec)

CONTROL CHANNEL INPUT SEQUENCE.)1, , , , , , ,
    (N=CHN FOR N=1-8)




    ->          ?-Help
```

Press (Shift,?) to display HELP (pg.1) below:

```
                TEST SET UP Line Item Descriptions (Pg 1)

Most of the line items have default entries with commonly occurring values or
choices. They may be overwritten.

 TEST DESCRIPTION - A one line (60 character maximum) description of the
     Test Setup.

 SWEEP TYPE - Enter either logarithmic or linear. Logarithmic is more
     frequently used.

 NUMBER OF SWEEPS - Enter the total number of sweeps that are specified for
     the test. Sweeps alternate in the up and down directions. If it is
     desired to run the test manually, and the sweep may be reversed manually
     a number of times during the test, an entry of 0 for continuous sweep
     would probably be the best choice.




          PgDn - to continue      Esc - back to menu
```

Press (PgDn) to display HELP (pg.2) on p. 3-13.

The HELP page below completes the explanation of the line items on p.3-12.

TEST SET UP Line Item Descriptions (Pg 2)

MAXIMUM SERVO SPEED - Four different compressor speed characteristics may be chosen. The compressor speed (dB/sec) varies from 10 dB/sec at 5 Hz to the maximum value (100, 300, 1k, or 3k dB/sec) at 5 kHz. The default value 1k dB/sec is usually adequate. However, using a tracking filter, providing average control, or encountering exceptionally high-Q resonances may require a lower value for amplitude stability. The choice of 3k dB/sec might be needed for exceptionally fast sweep rates.

CONTROL CHANNEL INPUT SEQUENCE - Select one of the eight input channels for single channel control. If the average control option using an input multiplexor has been supplied, specify channels in the sequence desired. Specifying one of the input channels more than one time will cause its weighting to be proportionately higher than other channels appearing only once in the sequence. Note, however, that average control is provided for constant acceleration control segments only. The channel specified first in the sequence is used for any constant displacement and velocity segments in the program.

TEST SETUP CONTROL KEYS on next page

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) for HELP (pg.3), which describes CONTROL KEY action.

TEST SET UP CONTROL KEYS (pg 3)

Esc - Exits the setup without recording changes. A "Y" answer to the subsequent prompt verifies that this is the true intent of the operation. A "N" answer cancels the Esc command.

Enter - Moves the cursor to the next entry in the setup list and displays the next page of the list if necessary.

End - Saves all setup entries on the hard disk and then returns to the Test Setup Menu

PgDn/PgUp - Moves to the next/previous page of the setup.

↑↓ - Moves the cursor to the entry above/below it.

(- - Moves the cursor one character to the left. If the cursor is on the first position of an entry it is moved to the first position of the entry to the left.

-) - Moves the cursor one character to the right.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (PgDn) to display the next page of TEST SETUP line items. See p.3-14

You may want to practice editing entries below. If you make an illegal entry, a flashing error message will generally appear.

```
SETUP ID : DEMO                    SINE TEST SETUP

LOWER FREQUENCY LIMIT (Hz) : ..)5

UPPER FREQUENCY LIMIT (Hz) : ..)2000

SWEEP TIME (Min) : ............)5

SWEEP RATE (Oct/min) : ........)1.73

STARTING SWEEP DIRECTION : ....)1
    (1=UP,2=DOWN)

STARTING FREQUENCY (Hz) : .....)5


   -)        ?-Help
```

Press (Shift,?) to display the HELP page below:

```
                TEST SET UP Line Item Descriptions (Pg 1)

Most of the line items have default entries with commonly occurring values or
choices. They may be overwritten.

 LOWER FREQUENCY LIMIT - Enter the frequency at which the sweep direction
     reverses from down to up.

 UPPER FREQUENCY LIMIT - Enter the frequency at which the sweep direction
     reverses from up to down.

 SWEEP TIME/RATE - Entering the SWEEP TIME for a single sweep between the
     FREQUENCY LIMITS causes the SWEEP RATE to be calculated automatically.
     Conversly, entering the SWEEP RATE in octaves/minute (logarithmic
     sweep) or hz./minute (linear sweep), causes the SWEEP TIME to be
     calculated automatically.




          PgDn - to continue      Esc - back to menu
```

Press (PgDn) to display the HELP page shown on p.3-15.

Did you notice the automatic calculation for SWEEP TIME or SWEEP RATE as described in the HELP page?

TEST SET UP Line Item Descriptions (Pg 2)

STARTING SWEEP DIRECTION - Enter the desired direction of the first sweep.

STARTING FREQUENCY - Enter the starting frequency. Note that if it is either the LOWER or the UPPER FREQUENCY, the STARTING SWEEP DIRECTION is also uniquely specified. If the LOWER or UPPER FREQUENCY is edited so that the STARTING FREQUENCY is outside this range, the STARTING FREQUENCY will be changed appropriately.

TEST SETUP CONTROL KEYS on next page

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) for a repetition of CONTROL KEY action.

TEST SET UP CONTROL KEYS (pg 3)

Esc - Exits the setup without recording changes. A "Y" answer to the subsequent prompt verifies that this is the true intent of the operation. A "N" answer cancels the Esc command.

Enter - Moves the cursor to the next entry in the setup list and displays the next page of the list if necessary.

End - Saves all setup entries on the hard disk and then returns to the Test Setup Menu

PgDn/PgUp - Moves to the next/previous page of the setup.

↑↓ - Moves the cursor to the entry above/below it.

(- - Moves the cursor one character to the left. If the cursor is on the first position of an entry it is moved to the first position of the entry to the left.

-) - Moves the cursor one character to the right.

PgUp - back up one screen Esc - back to menu

Practice moving the cursor with the CONTROL KEYS, and editing the entries in the Table below. Illegal entries will generally be acknowledged with a flashing error message.

SETUP ID : DEMO PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V)	LEVEL (mil pk-pk)	LEVEL (g's)	LEVEL (in/sec)	ABORT (+%)	ABORT (-%)
1	5	D	200	0.26	3.14	20	20
2	13.98	A	200	2	8.79	20	20
3	32.96	D	36	2	3.73	20	20
4	52.11	A	36	5	5.89	20	20
5	2000		0.02	5	0.15	20	20

LOWER FREQUENCY LIMIT = 5.0 Hz UPPER FREQUENCY LIMIT = 2000.0 Hz

-) Ins Del F2=Rescale ?-Help

Errors not acknowledged immediately will be displayed if an attempt is made to return to the SINE TEST SETUP Menu via (Esc)or (End). Press (Shift,?) to display the HELP page below.

TEST SET UP Line Item Descriptions (Pg 1)

Most of the line items have default entries with commonly occurring values or choices. They may be overwritten.

FREQUENCY - The entry gives the frequency at the low frequency end of each control segment.

FUNCTION - The entry specifies the vibration control function selected for each segment: D - displacement; A - acceleration; V - velocity.

LEVEL - The brightest level entry gives the vibration level of the controlled vibration function. The level of the other two functions are their corresponding values at the specified frequency.

ABORT - The abort levels are specified relative to the control values for each of the segments. Default values of 10 percent for each segment are shown. These may be overwritten.

NEW CONTROL KEYS
Ins Del F2

PgDn - to continue Esc - back to menu

Press (PgDn) for the HELP page shown at the top of p.3-17.

Note carefully the automatic calculations that are described on the Help page below.

TEST SET UP Line Item Descriptions (Pg 2)

A number of entry features of the Table are worth noting. The LOWER FREQUENCY LIMIT is automatically entered for SEGMENT #1 when the table is displayed, along with a function default entry of D. When the D is confirmed, the cursor moves to the displacement column of the LEVEL entry. When the displacement LEVEL is entered by the operator the other two levels are calculated automatically.

The entry for the FREQUENCY of SEGMENT #2 is accompanied by the automatic calculation of the vibration levels at this frequency, in accordance with the control level of SEGMENT #1. If A or V is entered and confirmed as the control function for SEGMENT #2, the cursor moves to the corresponding brightened level. Confirmation of the brightened value assumes a smooth transition from D to A or V at the crossover frequency. This procedure is repeated for all segments if different control functions are chosen for adjacent segments.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (PgDn) for a description of The special CONTROL KEYS on the HELP page below.

TEST SET UP CONTROL KEYS (pg 3)

The last entry in the FREQUENCY column is the UPPER FREQUENCY LIMIT. Editing of all values except the FREQUENCY for the first segment may be made on the TABLE. This frequency must be edited on the line item for LOWER FREQUENCY LIMIT. If the UPPER FREQUENCY is omitted on the PROGRAM TABLE, it will be inserted automatically when the End command is given. Note that no other entries for the last segment no. can be made except the frequency, although the vibration levels are automatically inserted.

Ins - Allows new segment entries at the cursor location without destroying existing segment entries.

Del - Deletes segment entry at the cursor location, and leaves remaining entries in order.

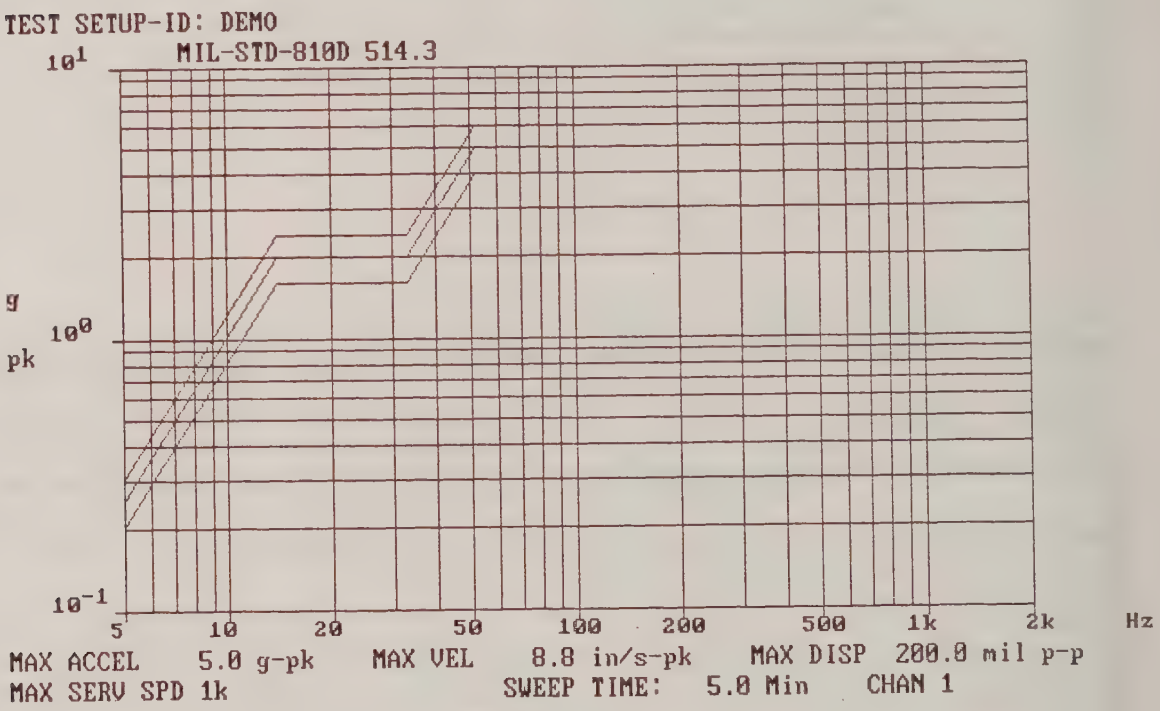
F2=Rescale - Rescales all level entries in the table by the specified change in dB.

PgUp - back up one screen PgDn - forward one screen Esc - back to menu

Press (Esc), the (PgDn) to obtain the display shown on p3-18.

Acceleration vs frequency, as described by the PROGRAM TABLE on p. 3-16 is shown on the graph below, which is a reduction from the actual display size. The graphical displays are copied at full size, and rotated 90° on the printed copy by pressing (F4).

The constant acceleration segment of 2g coincides with a grid line as do the 5g control segment and the corresponding 6g and 4g (±20%) abort limits. Color differentiates these lines on the actual display, however.



THIS MARKS THE END OF THE PRELIMINARY GUIDED TOUR OF THE U-D 400AT/S. Operations necessary for running a complete test are explained in Chapter 4.

4. PERFORMING THE SINE VIBRATION TEST

4.1 Introduction

In Chapter 3 we took a detailed tour through the various menus and test description procedures. We did, however, stop short of actually initiating a sine vibration test (See pp. 3-9 and 3-10). Now we are ready to take the steps necessary for performing and completing a test run. These steps, as well as data display techniques and operational procedures that are possible during the performance of the test, are explained in the following sections.

4.2 Initial Procedure

As outlined in Section 3.2, make sure that all installation procedures described in Chapter 2 have been completed successfully. Also check that the remainder of the procedures in Section 3.2 has been followed. The power amplifier should be turned on so that it is ready to apply a signal to the shaker. See the manufacturer's instructions if necessary. The amplifier gain control should be adjusted for maximum gain.

Again, when the U-D 400AT System Logo appears on the color monitor, we are almost ready to start the test.

If it is desired to check the 400AT without exciting the power amplifier and shaker, this can be done by connecting an attenuator (gain 0.2) or shaker simulation network between the DRIVE output and the CHANNEL 1 (10mV/g) input of the UD 340. The TEST SETUP entry for control channel sequence should show the single input channel.

4.3 Test Setup

As an aid to our understanding of the procedures in this chapter, and the parameters found on the graphical displays, we will obtain a copy of the SINE TEST SETUP that pertains to our TEST RUNS.

Press any key to display the MAJOR OPERATIONAL MODES Menu.
Press (F1) to display the S.V TEST Menu.
Press (F1) to display the SINE TEST SETUP Menu.
Press (F5) to print the SINE TEST SETUP used in the remainder of this chapter and found on p 4-2.

In response to PRINT TEST SETUP-ID: we typed (DEMO), (Enter).
In response to INCLUDE GRAPH <Y,N>? we entered (N). A copy of the printout for the SINE TEST SETUP parameters only is shown on the next page. The graph is shown on p 3-18.

The results described in the remainder of this chapter were actually taken on a U-D Model 5PM Shaker with a resonant load. The three control accelerometers were placed so that the acceleration PSD's differed considerably in the upper portion of the frequency range. In this fashion, the capability of the 400AT/S for average control can be demonstrated.

SINE TEST SETUP

TEST SETUP ID : DEMO LAST CHANGED: 10/03/86 12:45:38

TEST DESCRIPTION : MIL-STD-810D 514.3

SWEEP TYPE : .....)1
(1=LOG,2=LINEAR)

NUMBER OF SWEEPS : .....)0
(0=CONTINUOUS,1 to 9999)

MAXIMUM SERVO SPEED : .....)3
(1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec)

CONTROL CHANNEL INPUT SEQUENCE.)1, , , , , , ,
(N=CHN FOR N=1-8)

LOWER FREQUENCY LIMIT (Hz) : ..)5

UPPER FREQUENCY LIMIT (Hz) : ..)2000

SWEEP TIME (Min) : .....)5

SWEEP RATE (Oct/min) : .....)1.73

STARTING SWEEP DIRECTION : ....)1
(1=UP,2=DOWN)

STARTING FREQUENCY (Hz) : .....)5

SETUP ID : DEMO PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ABORT (+%)	ABORT (-%)
1	5	D	200	0.26	3.14	20	20
2	13.98	A	200	2	8.79	20	20
3	32.96	D	36	2	3.73	20	20
4	52.11	A	36	5	5.89	20	20
5	2000		0.02	5	0.15	20	20

LOWER FREQUENCY LIMIT = 5.0 Hz UPPER FREQUENCY LIMIT = 2000.0 Hz

4.4 Beginning The Test Run

After the printout of the SINE TEST SETUP begins, the queries disappear on the screen, and the SINE TEST SETUP Menu remains.

Press (F7 - RUN TEST) and three queries appear below the menu.

Enter (DEMO) for the TEST SETUP-ID.
Confirm (default entry) for the TEST RUN NAME.
Confirm (3) for no automatic data saves.
(The default TEST RUN NAME for a given setup is automatically changed after each test run in which data is saved, say from RUN2 to RUN3.)

In a few seconds, a graph with notations around the border is displayed, like the one on p 3-10. At the bottom is a two row display with space for describing the function of each of the ten FUNCTION KEYS. Only the active keys, however, have their function displayed in the associated space, and the remainder of the spaces are blank.

Just above the function key display, the Status message is displayed.

Status: Use function keys to continue.

The following function keys are active:

(F2-Configure); (F3-Auto); (F4-Print Screen); (F5-Manual); (F10-Leave Test)

A choice of (F10) causes the S.V. TEST Menu to be displayed again. A choice of (F3) causes the system to ramp up to the level specified in the PROGRAM TABLE for the starting frequency, the auto clock is then started, the frequency starts sweeping, and continues for the number of alternating up and down sweeps specified in the setup if no further interruptions occur. If the system is unable to reach 90% of the reference level during ramping, the test will abort.

If the MANUAL mode (F5) is chosen, the level will ramp up to 20 dB below the level specified for the starting frequency, and will remain at this level and frequency until further control operations are made. The AUTO clock does not run in the MANUAL mode, but the TOTAL clock runs continuously during the test run. The level may be changed by the up and down arrow keys on the numeric keypad, and the frequency may be changed by the right and left arrow keys.

The HELP pages may be displayed at any time during the test by pressing (Shift, ?) and are shown on the following pages. A summary of the CONTROL KEY action and various display alternatives is given.

Fig. 4-1

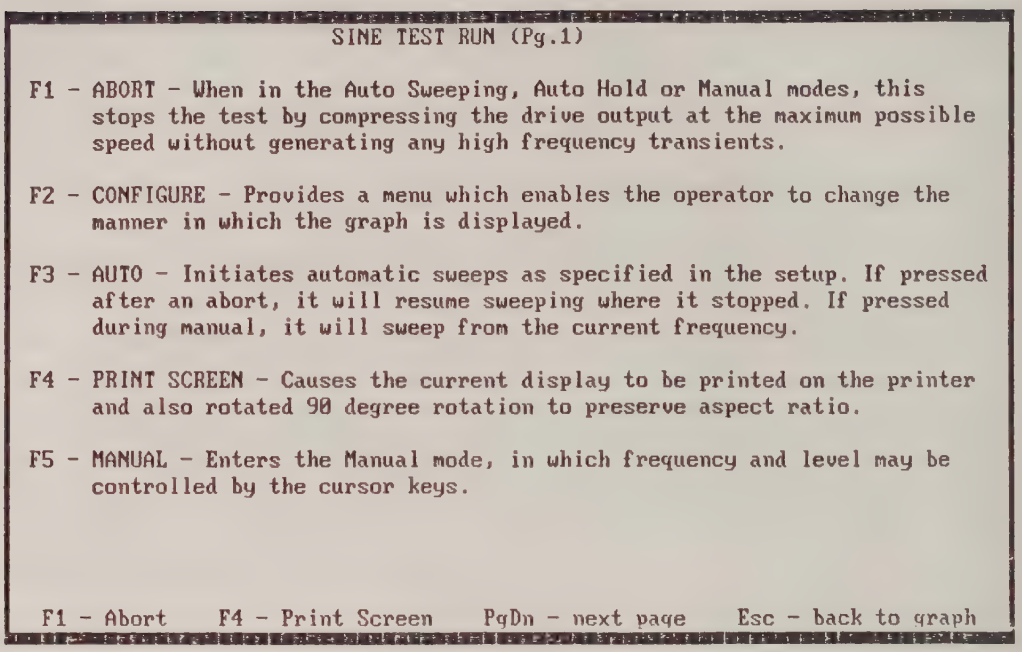

SINE TEST RUN (Pg.1)
F1 - ABORT - When in the Auto Sweeping, Auto Hold or Manual modes, this stops the test by compressing the drive output at the maximum possible speed without generating any high frequency transients.
F2 - CONFIGURE - Provides a menu which enables the operator to change the manner in which the graph is displayed.
F3 - AUTO - Initiates automatic sweeps as specified in the setup. If pressed after an abort, it will resume sweeping where it stopped. If pressed during manual, it will sweep from the current frequency.
F4 - PRINT SCREEN - Causes the current display to be printed on the printer and also rotated 90 degree rotation to preserve aspect ratio.
F5 - MANUAL - Enters the Manual mode, in which frequency and level may be controlled by the cursor keys.
F1 - Abort F4 - Print Screen PgDn - next page Esc - back to graph

Fig. 4-2

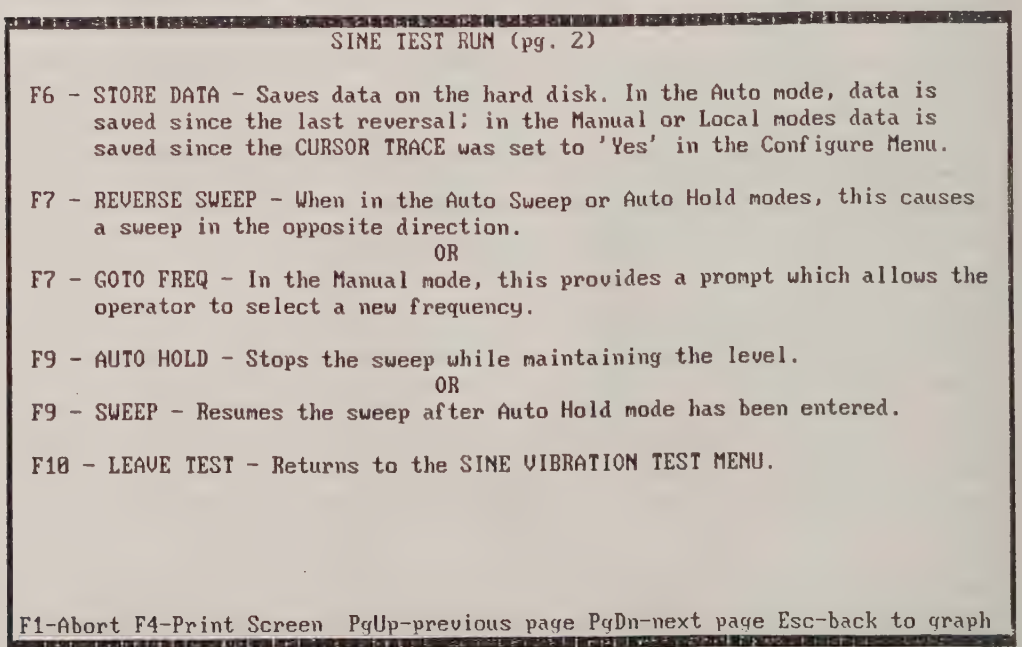
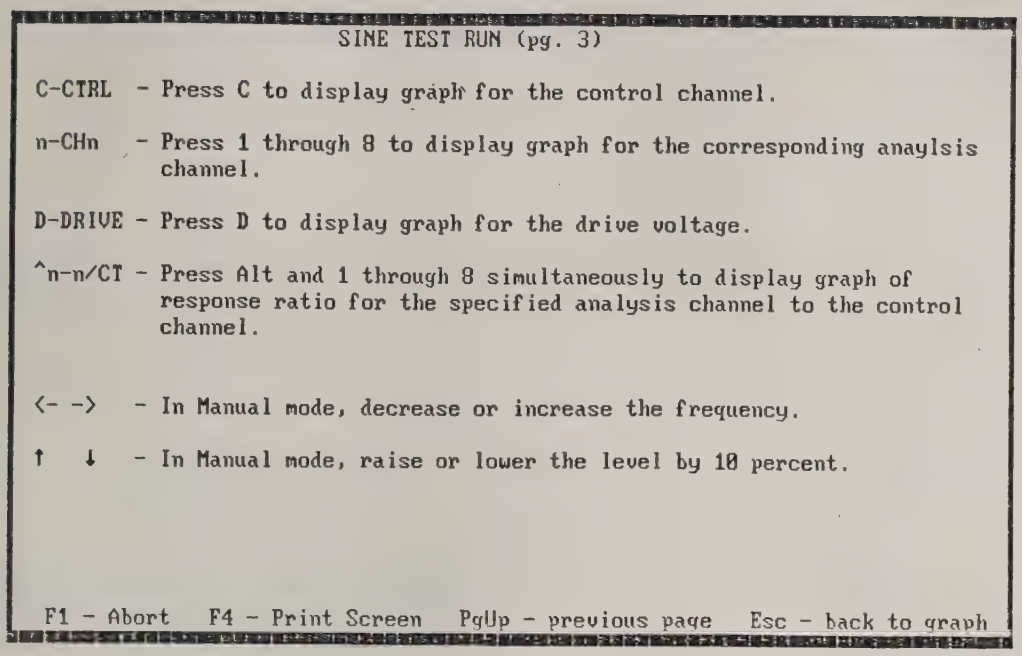

SINE TEST RUN (pg. 2)
F6 - STORE DATA - Saves data on the hard disk. In the Auto mode, data is saved since the last reversal; in the Manual or Local modes data is saved since the CURSOR TRACE was set to 'Yes' in the Configure Menu.
F7 - REVERSE SWEEP - When in the Auto Sweep or Auto Hold modes, this causes a sweep in the opposite direction.
OR
F7 - GOTO FREQ - In the Manual mode, this provides a prompt which allows the operator to select a new frequency.
F9 - AUTO HOLD - Stops the sweep while maintaining the level.
OR
F9 - SWEEP - Resumes the sweep after Auto Hold mode has been entered.
F10 - LEAVE TEST - Returns to the SINE VIBRATION TEST MENU.
F1-Abort F4-Print Screen PgUp-previous page PgDn-next page Esc-back to graph

Fig. 4-3


SINE TEST RUN (pg. 3)
C-CTRL - Press C to display graph for the control channel.
n-CHn - Press 1 through 8 to display graph for the corresponding anaylsis channel.
D-DRIVE - Press D to display graph for the drive voltage.
^n-n/CT - Press Alt and 1 through 8 simultaneously to display graph of response ratio for the specified analysis channel to the control channel.
<- -> - In Manual mode, decrease or increase the frequency.
↑ ↓ - In Manual mode, raise or lower the level by 10 percent.
F1 - Abort F4 - Print Screen PgUp - previous page Esc - back to graph

We will choose the AUTO mode to initiate the test:

Press (F3)

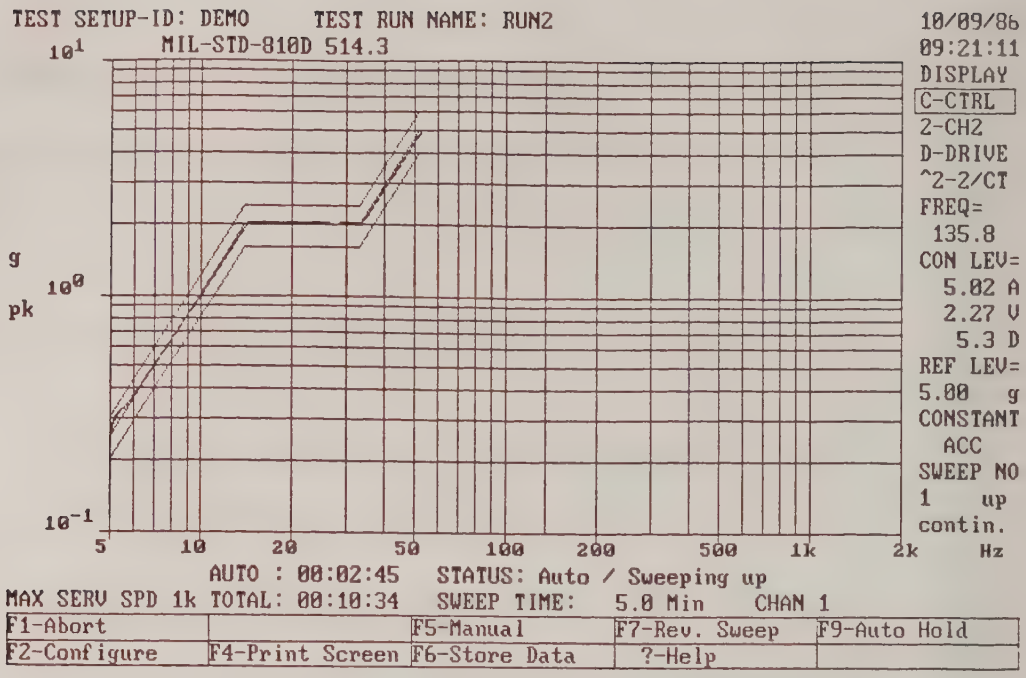
Immediately, the Status changes to "Ramping" and (F1-Abort) is the only active FUNCTION key. After a few seconds, the level comes up, and the Status changes to "Auto/Sweeping up". The display is nearly identical to the one on the next page.

The test has begun.

4.5 During the Test Run

The displays shown in the remainder of the chapter were obtained from printed copies obtained by pressing (F4-Print Screen) when a copy was desired. The (F4) command causes the graphical displays to be rotated 90 degrees before appearing on the printer paper. This allows the graphical material to occupy a full sheet of the 8.5 x 11 printed copy. The copies shown in this manual are reduced to approximately 65% of full size to conserve space. Do not attempt to use the (Shift, PrtScr) command to print graphical displays, because this cause useless printer output.

Fig. 4-4



Note that the moving cursor during the sweep is shown at 135.8 Hz in the display.

Most relevant test information can be found on the display. On the top border, the TEST SETUP-ID and TEST RUN-NAME are given, with the TEST DESCRIPTION from the setup on the line below. In the upper right-hand corner the current date and time are shown.

On the right border, the parameters which can be plotted on the graph are listed under DISPLAY, with the one currently in use surrounded by a box. Below these are: the current frequency; the current level in g-peak, in/s-peak and mils pk-pk; the reference level for the current segment; the current sweep number; the maximum number of sweeps (or "continuous").

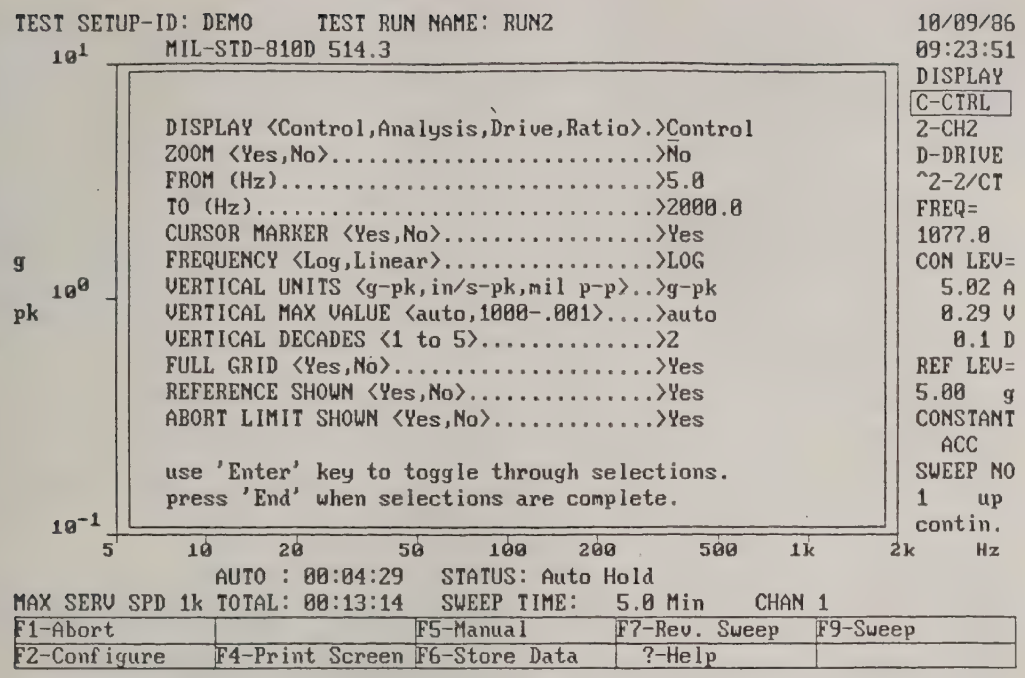
Below the graph, CHAN indicates the channels that are averaged to produce the control level, and SWEEP TIME indicates the time that a full up or down sweep will take.

There are two clocks which relate to test duration. AUTO displays the time during the test spent AUTO sweeping only. TOTAL displays the time elapsed since the graph was initially displayed after RUN TEST was pressed.

The MAX SERV SPD entry indicates the compressor speed (in dB/sec) that was selected in the setup to occur at 5 kHz.

To change the configuration of the test graph, press (F2-Configure). The configuration parameters then appear in place of the graph as shown on the next page.

Fig. 4-5



To change one of these parameters, move the cursor up or down to the parameter to be changed, and press (Enter) to toggle to the desired new selection. The FROM and TO are numerical selections which must be typed and confirmed.

DISPLAY - The variable appearing on this graph as a function of frequency is selected here. Four choices are available: Control, Analysis, Drive Voltage, or Transfer Ratio. Each of these has its own dimensional units which appear in the parameter selection VERTICAL UNITS.

ZOOM - A 'Yes' response activates the numerical frequency limits for the horizontal axis in the FROM and TO entries. Otherwise the 'No' response provides the entire frequency range specified in the SINE TEST SETUP.

CURSOR MARKER - A 'Yes' response provides a bright vertical cursor at the current frequency. In the MANUAL or LOCAL modes, this parameter becomes CURSOR TRACE. A 'Yes' response produces a single dot which produces a trace as the frequency and amplitude is varied. The 'No' response produces a cursor shaped like plus sign which moves to show the current amplitude and frequency.

FREQUENCY - Selection of logarithmic or linear frequency scales is provided. The sweep type specified in the SINE TEST SETUP does not change however.

VERTICAL UNITS - Selection of acceleration, velocity or displacement units is provided for Control or Analysis Channel displays. Note that the units are peak values for acceleration and velocity and peak-to-peak for displacement. The units for a Drive Voltage display are rms volts. The Transfer Ratio display is dimensionless.

VERTICAL MAX. VALUE - Selection of 'Auto' provides maximum and minimum decade values that will allow plotting of the entire reference vibration level and the associated abort limits for the Control and Analysis Channel displays. Otherwise the maximum value is determined by the numerical selection chosen from .001 to 1000 g.

VERTICAL DECADES - The entry is ignored if 'Auto' is chosen above. Otherwise the numerical number of decades chosen provides a minimum value for the vertical axis. The scaling is logarithmic.

FULL GRID - A 'Yes' response provides a full set of horizontal and vertical grid lines. Otherwise no background lines are presented.

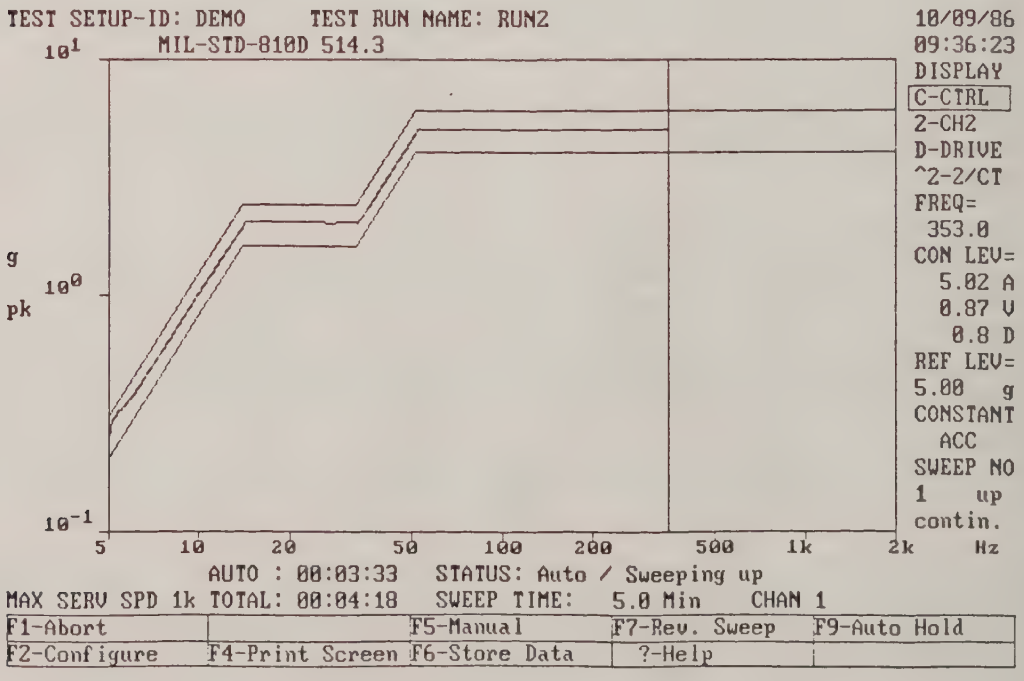
REFERENCE SHOWN - A 'No' response eliminates the display of the reference vibration level as a function of frequency.

ABORT LIMIT SHOWN - A 'No' response eliminates the display of the abort limits as function of frequency.

ANAL. CHAN. MAX. VALUE - This parameter is shown only if the Analysis Channel is selected for display. The response is similar to that for VERTICAL MAX. VALUE.

Some operators may prefer not to see the grid lines or the reference acceleration, as they may tend to obscure some data details. To remove the grid lines, move the cursor to FULL GRID and toggle to the "No" response by pressing the (Enter) key. To remove the reference acceleration graph, move the cursor to REFERENCE SHOWN and toggle "No". The resulting display is shown below.

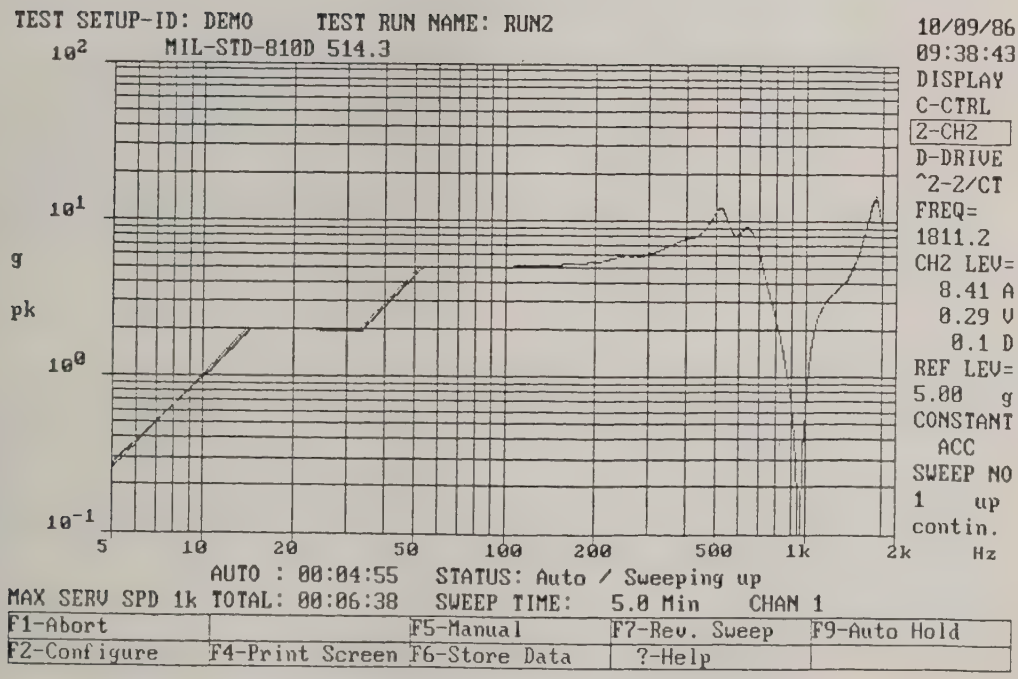
Fig. 4-6



When the independent analysis channel has been supplied, the data for this channel may be seen by pressing (2), the number associated with the Analysis channel. Channel 1 is always the control channel when the averaging option has not been supplied. If 8-channel averaging has been supplied, channels 1 through 8 are available for viewing and any sequence of as many as 8 channels is available for control.

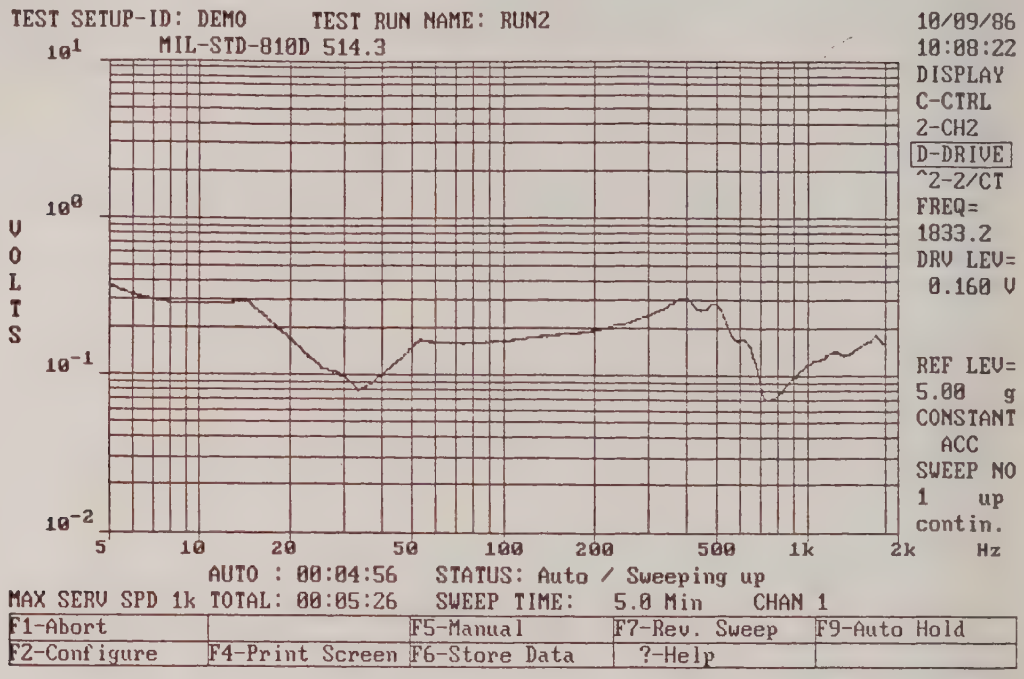
Assuming for the moment that only the analysis channel has been supplied, pressing (2) to view the graph for the Analysis channel yielded the display below:

Fig. 4-7



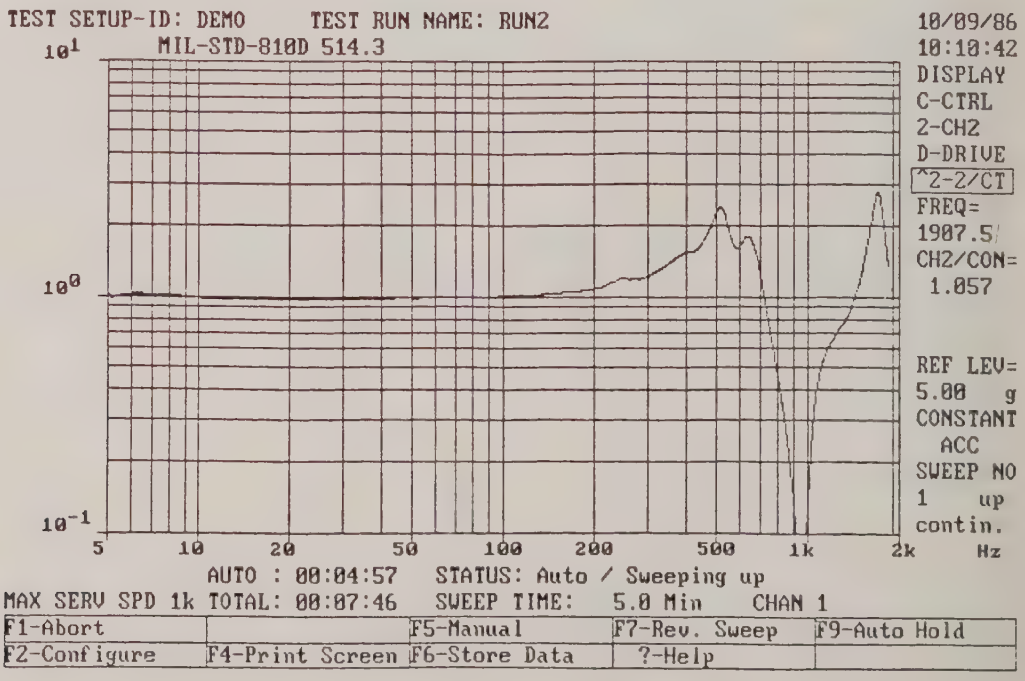
The drive voltage is viewed by pressing (D) and is shown below:

Fig. 4-8



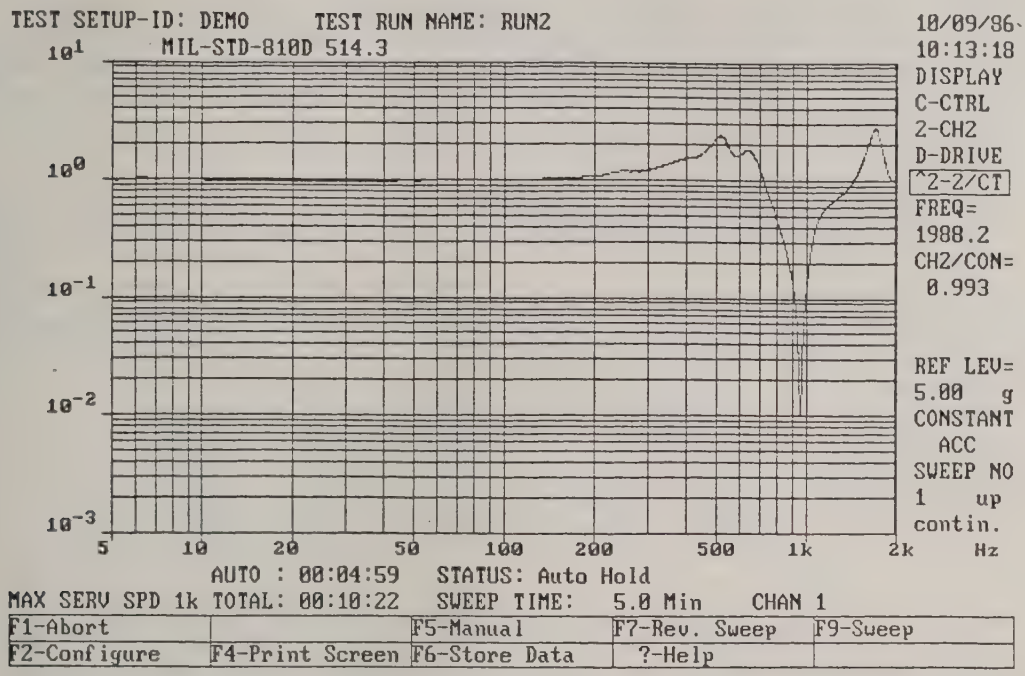
The transfer ratio of the acceleration of the Analysis channel to the acceleration of the Control channel is viewed by pressing the keys (Alt,2) simultaneously. The display is shown below.

Fig. 4-9



Reconfiguration of the transfer ratio graph to provide four vertical decades allows the notch at 950 Hz to be seen more clearly:

Fig. 4-10



4.6 MANUAL Mode

The MANUAL Mode allows the operator to operate the system from the keyboard and change both frequency and amplitude by using the four arrow CONTROL KEYS. At all times the vibration amplitude remains under closed-loop control.

Press (F5) to establish the MANUAL Mode. If the MANUAL Mode was entered when the system was sweeping at the reference level (AUTO Mode) or being held at the reference level (AUTO HOLD Mode), any frequency sweep stops and the vertical cursor is replaced by the cursor shaped like a large plus sign. The controlled vibration level is the reference level.

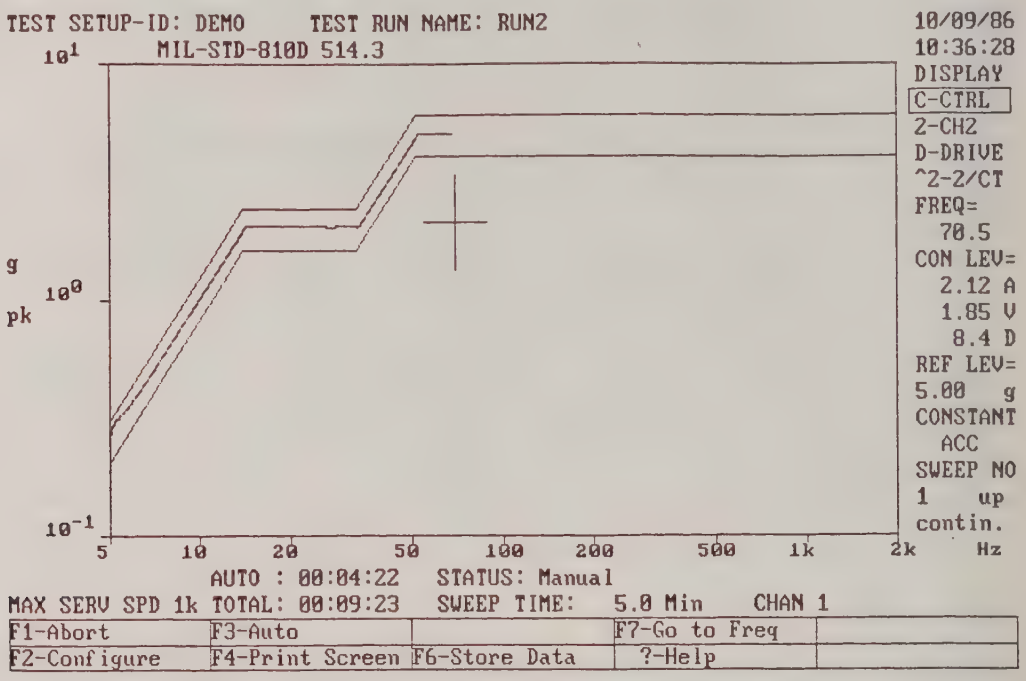
If the MANUAL Mode is entered to begin the test, or after the test is aborted by pressing (F1), the vibration level ramps automatically to a level 20 dB below the reference level.

Pressing the UP or DOWN arrow key changes the level by either + or - 10%, but in no case will the level be allowed to exceed the upper abort limit or be less than 10% of the reference level (-20 dB).

Pressing the LEFT or RIGHT arrow key causes the frequency to decrease or increase by a small amount. The vibration level maintains the preexisting ratio with respect to the reference level. Pressing (Shift) simultaneously with an arrow key causes the frequency to change by a much larger amount.

The display shown below was obtained after pressing (F5) and then decreasing the level by 10% several times with the DOWN arrow key. The grids and the reference level were removed by changing the CONFIGURE Menu.

Fig. 4-11



A new function key is active in the MANUAL Mode. Pressing (F7) produces a prompt asking for a new frequency. After the frequency has been typed and entered, the drive voltage goes to zero beiefly the frequency is changed and the vibration level ramps to the same level relative to the reference level that was established prior to the request for a new frequency.

In no case can the operating frequency change to a value outside the boundary values specified in the TEST SETUP.

4.7 LOCAL Mode

The LOCAL Mode allows the operator to control the vibration frequency and level from controls on the front panel of the UD340. In the LOCAL Mode, the AT-400/S is in open loop operation, and no safety limits are provided. Operator care and discretion are very important.

To enter the LOCAL Mode:

1 - Turn the OUTPUT Control CCW to RESET.

2 - Turn the key switch from KEYBOARD to LOCAL with the UD340 key.

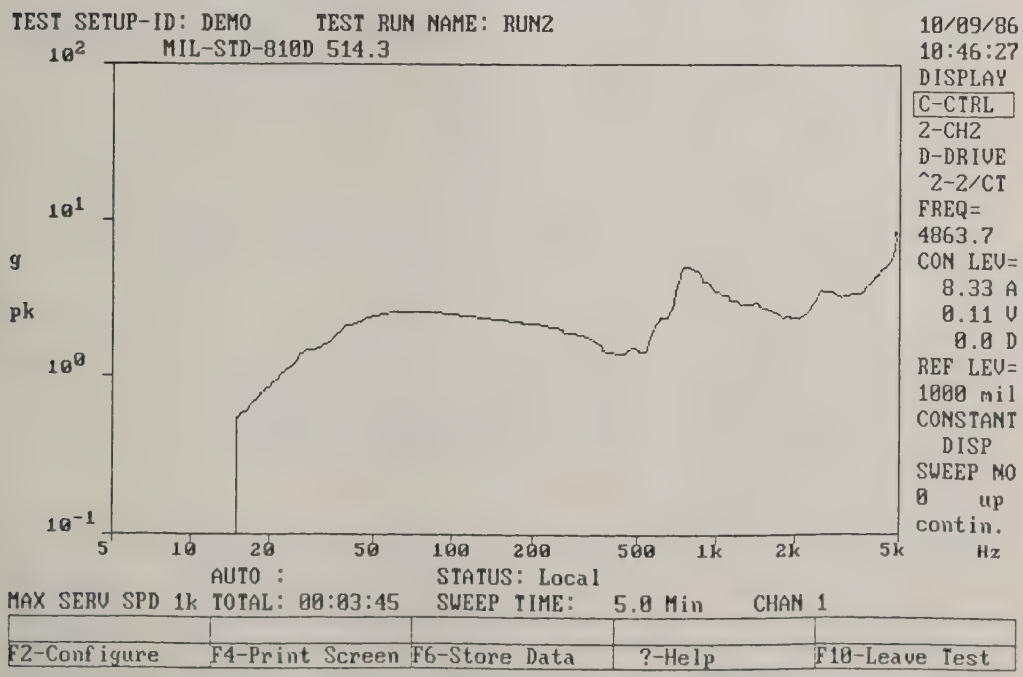
After a short time, the screen is rescaled to show a 5 Hz to 5 kHz frequency range. The vibration amplitude and level are indicated by the plus-shaped cursor.

The drive voltage is controlled, and consequently the vibration level, by the OUTPUT Control. The frequency is adjusted by the COARSE and FINE controls.

The vibration level may be read from the digital meter on the front panel of the UD340 in acceleration, velocity or displacement units, by pressing the button beside the appropriate LED indicator. These buttons are not active except in the LOCAL Mode.

The display below was obtained by configuring the cursor to the CURSOR TRACE Mode. In the lower frequency portion of the display the OUTPUT was increased initially at about 15 Hz and the frequency was increased slowly for constant drive.

Fig 4-12



Leave the LOCAL Mode by turning the key on the front panel of the UD340 from LOCAL to KEYBOARD. The vibration graph disappears from the screen and the SINE VIBRATION TEST Menu reappears.

4.8 Other CONTROL Keys

When the frequency is sweeping in the AUTO Mode, pressing (F9) causes the sweep to stop and the frequency to hold or remain constant. The vibration level remains at the reference level. Sweeping is resumed by pressing (F9) a second time. Time spent in the AUTO HOLD Mode is not included on the AUTO clock.

When the frequency is sweeping or in the AUTO HOLD Mode, pressing (F7) causes the frequency to sweep in the opposite direction. Each time the sweep is reversed by (F7), the sweep number is incremented.

4.9 Average Control (Option)

For those systems in which the average control option has been supplied, a number of comments concerning the operation and flexiblity of the system are offered in this section.

First of all, the test setup DEMO printed on Page 4-2 was edited to accommodate three input channels. The line item below was changed as shown:

CONTROL CHANNEL INPUT SEQUENCE..> 1,2,3, , , , ,

The control signal for constant acceleration control segments is the multiplexed signal for a channel sequence of 1,2,3. For constant displacement and constant velocity segments in the test setup, the control signal is changed to the first channel in the sequence designation (i.e. Channel 1).

Single channel control is required for constant D or V segments because a wide-band controller is required for sine-average control using a multiplexer. Integration of a multiplexed control signal can actually create frequencies in the integrator output which do not occur in the original control signals, thus causing incorrect control amplitudes.

Requiring control from a single channel for constant D and V control segments is not really a serious objection. This restriction has been used successfully for over two decades because practically all of the constant D or V control segments occur at low frequencies where there are few resonances, and a single control channel can be used effectively.

The amplitude of the Control signal is shown on the following graph near the end of the first sweep. The grids and the reference curve have been suppressed by reconfiguring the graph.

Data for the acceleration signal of Channel 1 is also being saved while the control signal is being displayed. Pressing (1) displays the graph shown below that for the control signal.

Fig. 4-13

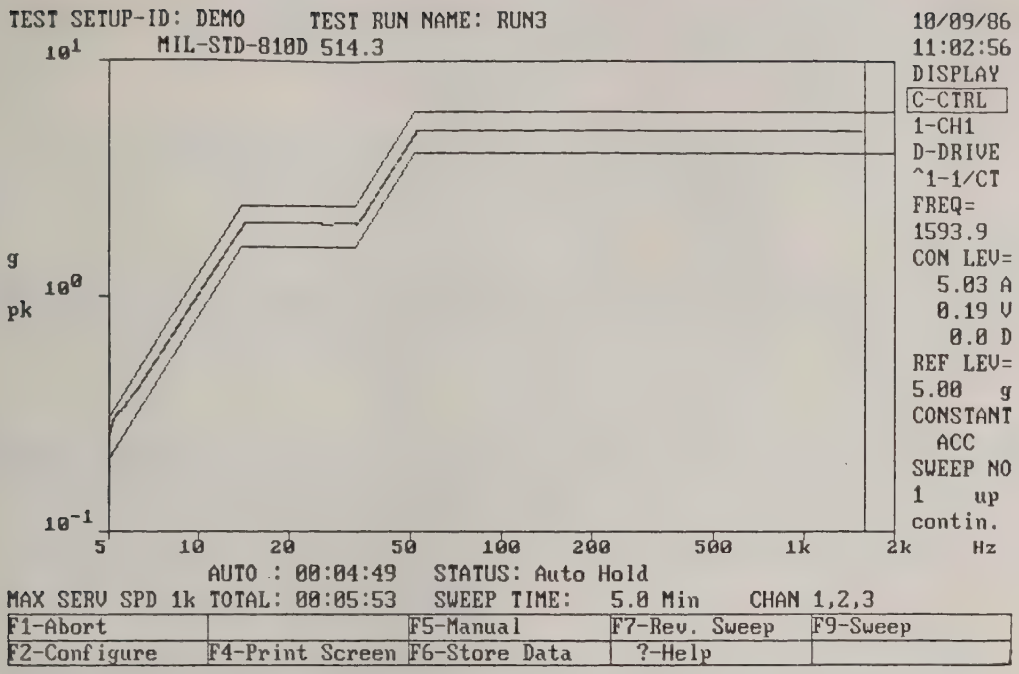
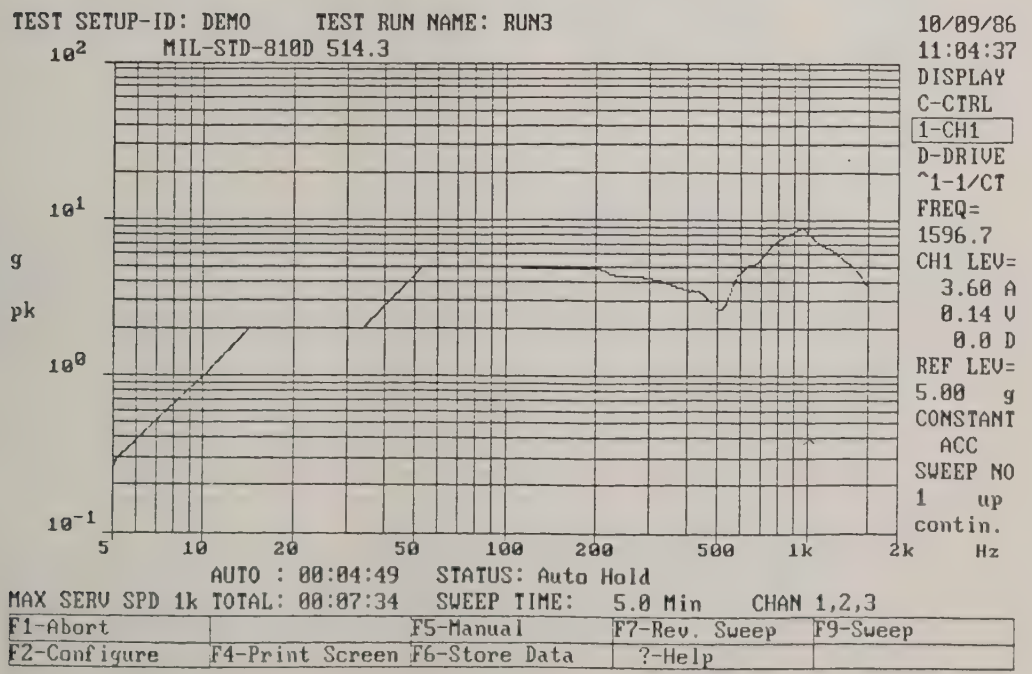


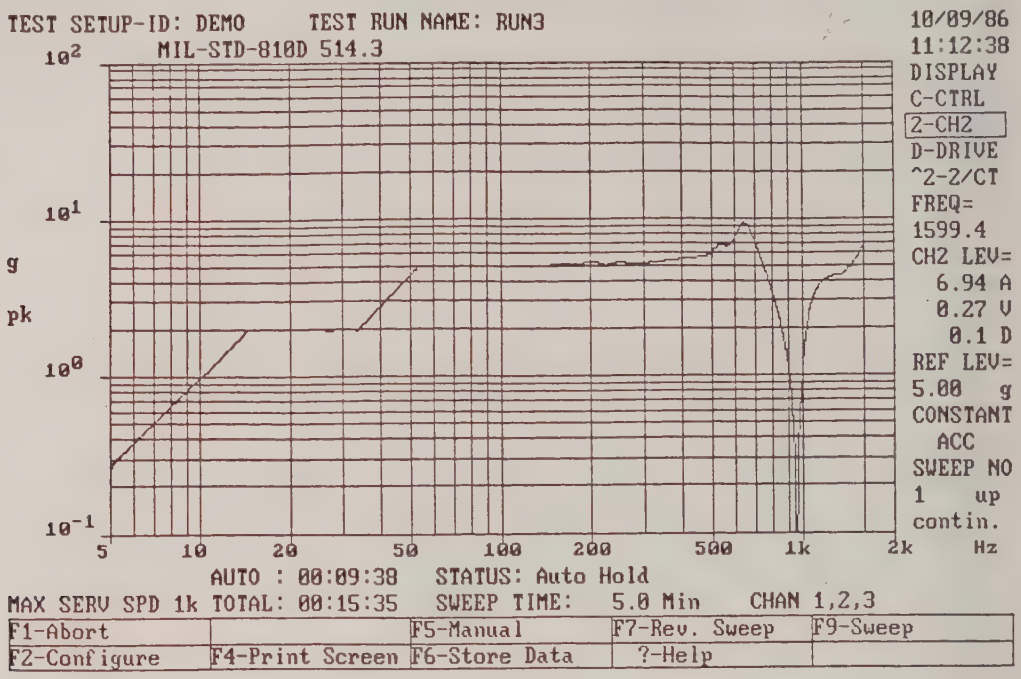
Fig. 4-14



To obtain the graph for Channel 2 acceleration, the test was re-started after pressing (2). This is necessary to obtain the graph for Channel 2, since only the control acceleration and the channel number showing under the DISPLAY notation have data stored for each sweep along with the drive voltage. Channel 2 data could have

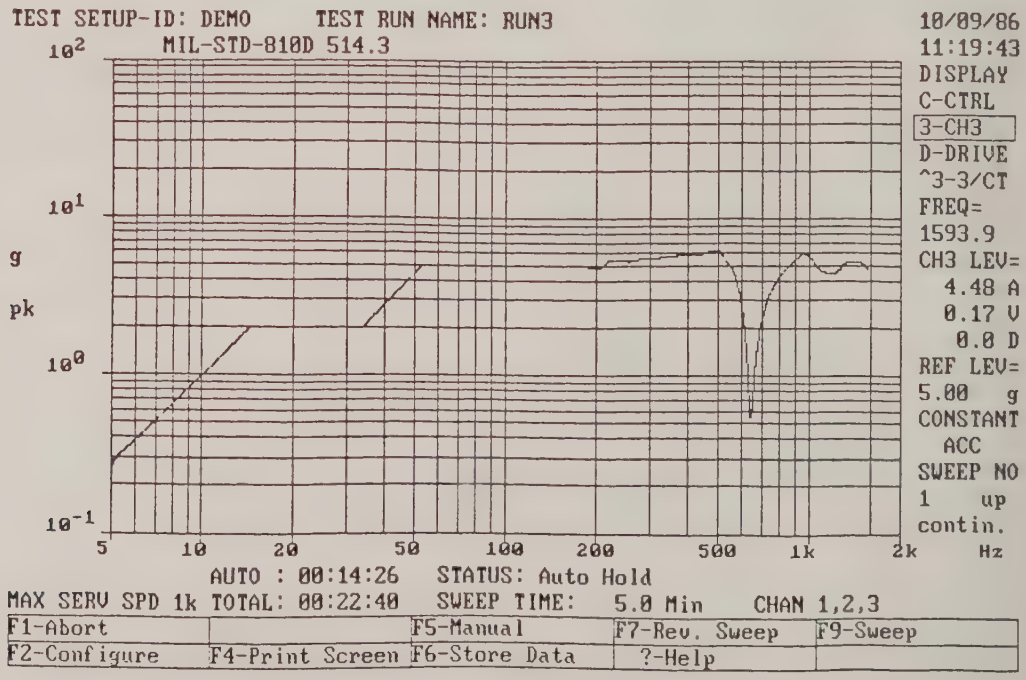
been obtained after completion of the first up-sweep by pressing (2), and waiting for the completion of the second (down) sweep. The graph for Channel 2 data follows:

Fig. 4-15



In a similar fashion, the graph for Channel 3 is obtained and is shown below:

Fig. 4-16



It shall be noted from the above display that the resonance effects are evident above 200 Hz. At any frequency, if data from all three channels is taken from the graphs and averaged the result should be the control acceleration. For example at 1000 Hz we have:

$$(8.0 + 1.0 + 5.6)/3 = 4.9 \text{ g}$$

One further comment is necessary. If resonance effects are noticeable at a crossover from a D or V segment to an A segment, or vice versa, the test may be stopped due to exceeding the abort limits near the crossover frequencies.

Consider the situation in which the amplitude of the control channel acceleration for a D control segment just before crossover is considerably less than the controlled amplitude of that same acceleration for an A segment just after crossover. This could happen if the acceleration(s) for the other control channels for the A-segment are much less than the one chosen for D segment control (due to specimen resonances).

When crossover from D to A occurs, the control signal switches suddenly from a single channel to a multiplexed signal and amplitude of the control signal suddenly decreases. The action of the AGC circuit causes the control signal to increase to the proper level, but not before the negative going amplitude is recorded. The action occurs in the opposite fashion if the crossover is from A to D for the reverse direction sweep. If the abort limits are too close, they will be exceeded and the test will be stopped.

Two possible remedies are possible for this seldom occurring situation:

1 - Widen the abort limits
2 - Change the CONTROL CHANNEL INPUT SEQUENCE so that the single channel acceleration selected for D or V control is close to the average acceleration for A control near the crossover frequency.

5. SAVING AND RETRIEVING DATA

5.1 Introduction

To demonstrate the capability of the 400AT/S for storing and retrieving data, the test setup on page 4-2 will be run.

With the SINE VIBRATION TEST Menu displayed,
Press (F7).
Confirm or enter: (DEMO).
Confirm the automatic updated entry for the RUN NAME: (RUN 2).
Override the default entry (3) for SAVE TEST DATA and enter (1).
The resulting display is shown below just before the final entry.

```
                        SINE VIBRATION TEST          ver: 11/18/86 12:31:47

F1 = TEST SETUP                          F2 =

F3 =                                     F4 =

F5 = TEST DATA                           F6 =

F7 = RUN TEST                            F8 =

F9 =                                     F10 = EXIT TO PREVIOUS MENU

RUN TEST SETUP-ID : DEMO
ENTER RUN NAME....: RUN2
SAVE TEST DATA?...: 1
     <1=FIRST SWEEP,2=ALL SWEEPS,3=NO>

     Esc (Back to Menu)      Enter (Accepts Entry)
```

Fig. 5-1

The general procedures in this chapter are almost identical with those for the 400AT/R for random vibration testing. The reader who is familiar with those procedures will probably be satisfied with a quick review of the following material.

5.2 Running the Test

The test is initiated after the final entry for the display in Fig. 5-1 is confirmed.

After 00:02:44 of the test run has elapsed, (F6) is pressed causing the host to store data for Data Set 1. The red LED on the host computer shows that the data save is being accomplished. After the first sweep is completed at 00:05:01, the red LED again shows that the automatic data save requested is being accomplished for Data Set 2.

Since the DEMO test was programmed for continuous sweeps, pressing (F1) causes the test to abort and pressing (F10-LEAVE TEST) causes the SINE VIBRATION TEST Menu to be displayed again.

5.3 Retrieving the Data

Press (F5-TEST DATA) to provide a display of the SINE TEST DATA Menu shown below in Fig. 5-2.

```
                        SINE TEST DATA

F1 =                                    F2 =

F3 = DISPLAY TEST GRAPH                 F4 = DISPLAY TEST RUN LIST

F5 =                                    F6 = PRINT TEST RUN LIST

F7 = DELETE RUN                         F8 =

F9 =                                    F10 = EXIT TO PREVIOUS MENU

SELECT A FUNCTION KEY

?-Help
```

Fig. 5-2

In actual practice considerable time may have elapsed since the running of the test and the reviewing of the data, so it may be necessary to refresh our memory before we decide to press (F3-DISPLAY TEST GRAPH).

Press (F4) to provide a display of the DISPLAY TEST RUN LIST Menu shown in Fig. 5-3. If additional information is needed, press (Shift, ?) to display HELP messages.

```
                    DISPLAY TEST RUN LIST

F1 = SUMMARY LIST                       F2 =

F3 = DETAILED LIST WITH DATA SETS       F4 =

F5 = SINGLE TEST DATA SETS              F6 =

F7 =                                    F8 =

F9 =                                    F10 = EXIT TO PREVIOUS MENU

SELECT A FUNCTION KEY

?-Help
```

Fig. 5-3

Press (F1) to display a list of TEST SETUP 1D's and associated RUN NAMES for which data has been saved. The date and time the TEST SETUP was last edited and the date and time of the beginning of each test run is also displayed. Scrolling the display by pressing any key repetitively produces the display for DEMO which is shown in Fig. 5-4. The entry for RUN 2 confirms the data save of interest to us.

SUMMARY LIST OF TEST SETUP and RUN NAMES

TEST SETUP ID	DATE	TIME	RUN-NAME	DATE	TIME
1 DEMO					
1	11/25/86	12:36:28	RUN1	11/25/86	12:36:59
2	11/25/86	12:36:28	RUN2	11/25/86	14:02:06
2 LEE					
1	11/24/86	17:38:24	RUN1	11/24/86	17:44:23
3 LEEO					
1	11/24/86	20:51:41	RUN1	11/24/86	20:52:18
2	11/24/86	21:19:49	RUN2	11/24/86	21:19:58
3	11/25/86	07:41:10	RUN3	11/25/86	07:41:18
4	11/25/86	08:01:44	RUN4	11/25/86	08:01:55
5	11/25/86	08:31:23	RUN5	11/25/86	08:31:54

Fig. 5-4

Press (Esc) to return to the DISPLAY TEST RUN LIST Menu and then press (F5). Enter or confirm (DEMO) and enter or confirm (RUN 2) in response to the queries that appear below the menu as shown in Fig. 5-5.

The list shown in Fig. 5-6 is immediately displayed, and shows the DATA SETS saved when RUN 2 was made earlier. The time in the AUTO TEST mode is listed along with the total test time, the current status, sweep number and direction and the current active measurement/analysis channel.

DISPLAY TEST RUN LIST

F1 = SUMMARY LIST F2 =

F3 = DETAILED LIST WITH DATA SETS F4 =

F5 = SINGLE TEST DATA SETS F6 =

F7 = F8 =

F9 = F10 = EXIT TO PREVIOUS MENU

LIST TEST SETUP-ID : DEMO
ENTER RUN NAME....: RUN2

Fig. 5-5

LIST OF TEST SETUP and RUN NAMES

TEST SETUP ID	DATE	TIME	RUN-NAME			DATE	TIME
	Data Set	Auto Time	Total Time	Status	Sw. no.	Dir.	Channel
1 DEMO							
1	11/25/86	12:36:28	RUN2			11/25/86	14:02:06
	1	00:02:44	00:03:04	Auto	1	up	2
	2	00:05:01	00:05:21	Auto	1	up	2

Fig. 5-6

Press (Esc) - return to DISPLAY TEST RUN LIST Menu.
Press (F10) - return to SINE TEST DATA Menu.
Press (F3) - causes queries to appear below menu, as shown in Fig. 5-7.
Confirm or enter (DEMO).
Confirm or enter (RUN 2).

SINE TEST DATA

F1 =
F2 =
F3 = DISPLAY TEST GRAPH
F4 = DISPLAY TEST RUN LIST
F5 =
F6 = PRINT TEST RUN LIST
F7 = DELETE RUN
F8 =
F9 =
F10 = EXIT TO PREVIOUS MENU

DISPLAY TEST SETUP-ID : DEMO
ENTER RUN NAME.....: RUN2

Fig. 5-7

The last entry shown in Fig. 5-7 causes the CONTROL channel data for DATA SET 1 to be displayed. For clarity, the resulting graph shown in Fig. 5-8 below is reconfigured (by pressing F2) to eliminate the grid lines, and the reference graph. The cursor has also been positioned to show the last data point.

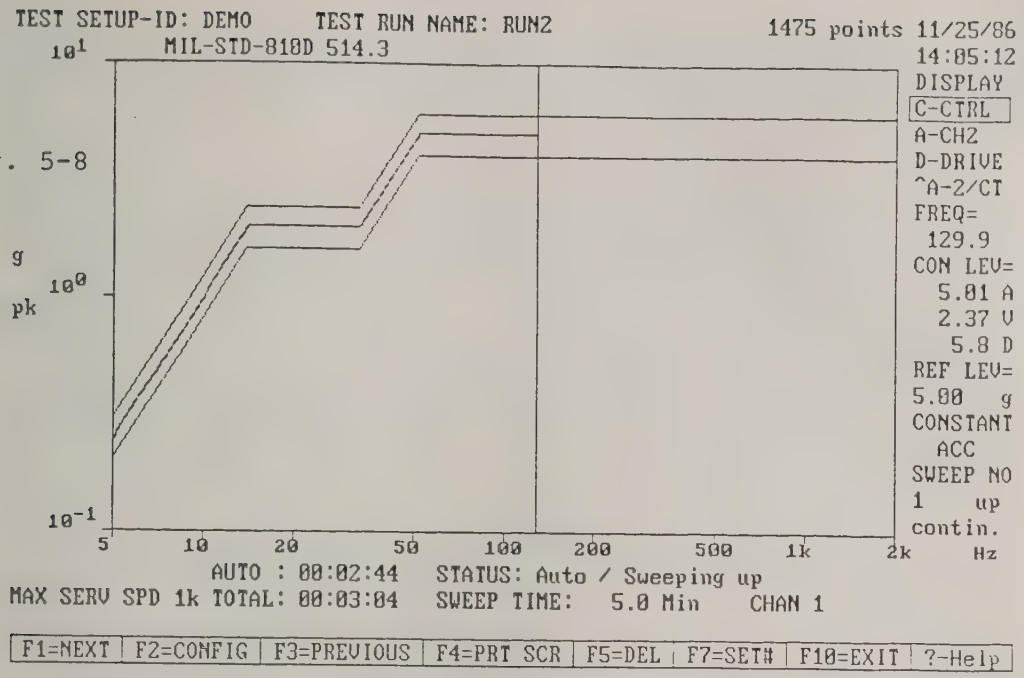


Fig. 5-8

Three other graphs could be viewed by typing (A), (D) or (Alt, A). Pressing (F1) causes the CONTROL channel data for the next data set (#2) to be displayed as shown in Fig. 5-9. However, when the stored number of data sets is numerous, it may be desirable to press (F7) and respond with a desired data set number to skip to the desired set.

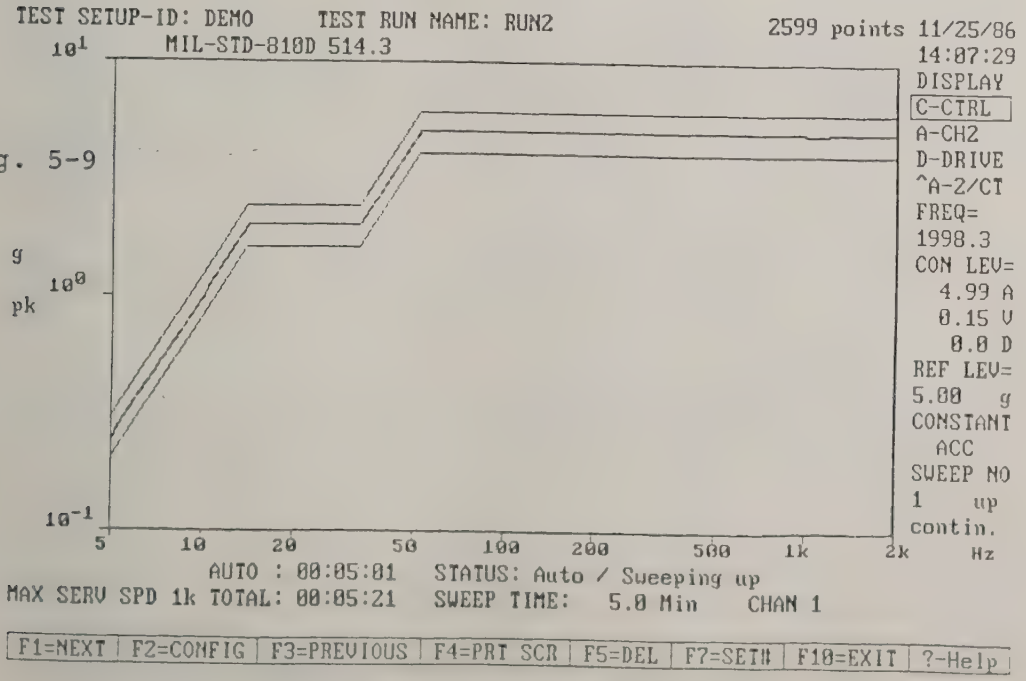
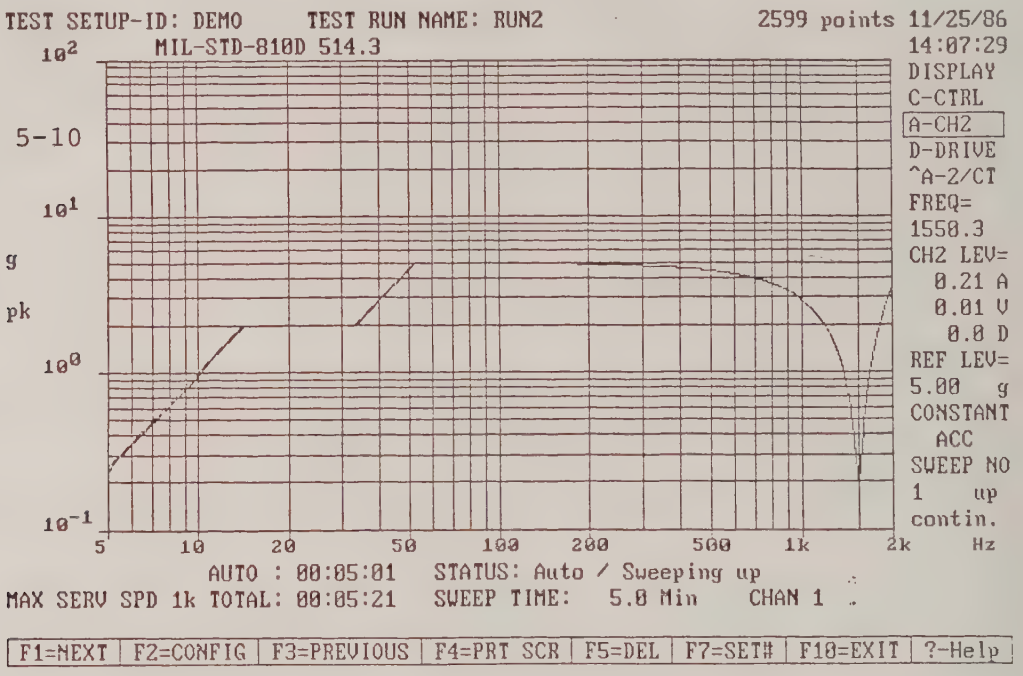


Fig. 5-9

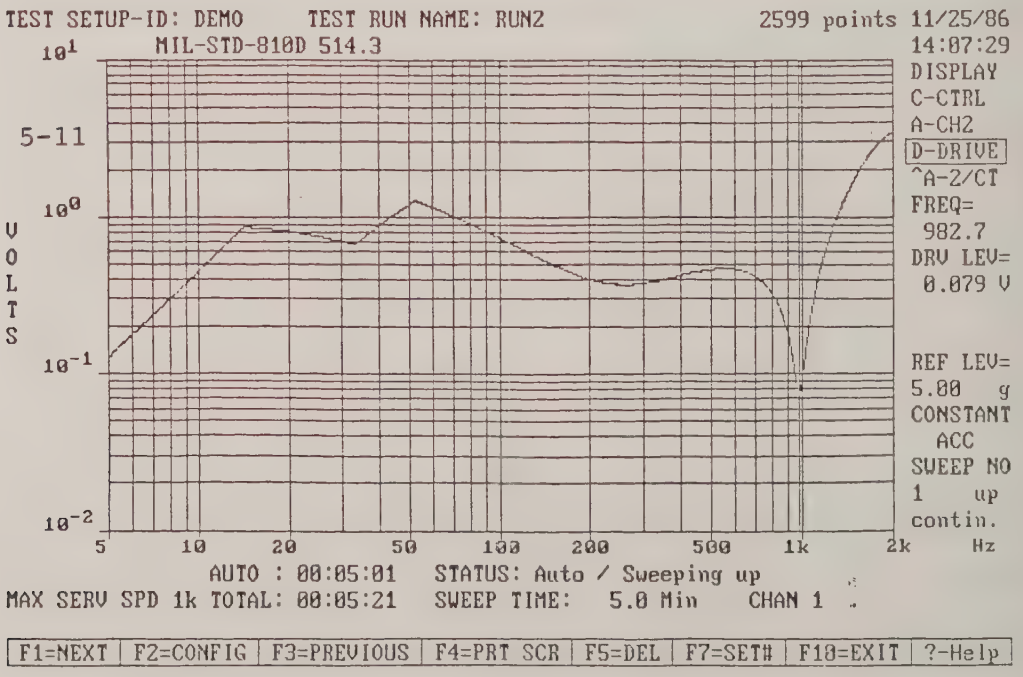
Fig. (5-9) has been reconfigured to eliminate the grid lines and reference acceleration. Pressing (A) displays the acceleration vs frequency for Channel 2, shown in Fig. 5-10. The cursor has been positioned at the minimum response point at 1550.3 Hz.

Fig. 5-10



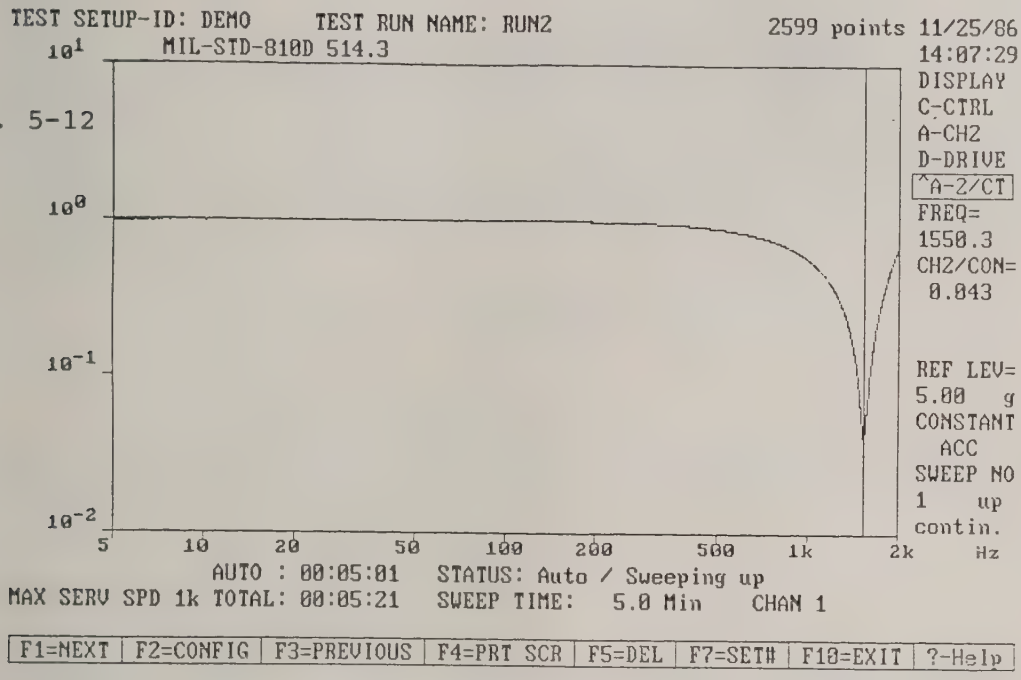
The graph for drive voltage vs frequency is displayed by pressing (D) and is shown in Fig. 5-11. The cursor is placed at the minimum response frequency, 982.7 Hz.

Fig. 5-11



Finally, the transfer ratio of Channel 2 acceleration to Control channel acceleration is displayed by pressing (Alt, A). The graph shown in Fig. 5-12 is reconfigured to clearly show the unity response at low frequencies and the minimum response resonance shown in Fig. 5-9.

Fig. 5-12



For systems with the average control option, any one of the eight input channels may be selected for the measurement channel. If data saves for different measurement channels are desired, the measurement channel must be changed appropriately during the test, preferably immediately after the data save is made for the sweep just completed. The number displayed on the screen indicates the active measurement channel, even though the control acceleration or drive voltage may be displayed at the time.

5.4 Changing the Configuration of Data Graphs

Several data graphs (Figs. 5-8, 5-9 and 5-12) were reconfigured to make the essential portions more distinct. The reconfiguration operation for data graphs is identical to that for test graphs. One mode of reconfiguration which is different from those for random vibration testing graphs deserves further illustration.

Pressing (F2) displays the configuration parameters which are reproduced in Fig. 5-13. Moving the cursor to VERTICAL UNITS and toggling ENTER until (in/s-pk) appears allows the CONTROL display to be plotted in terms of velocity. A displacement display could also be obtained.

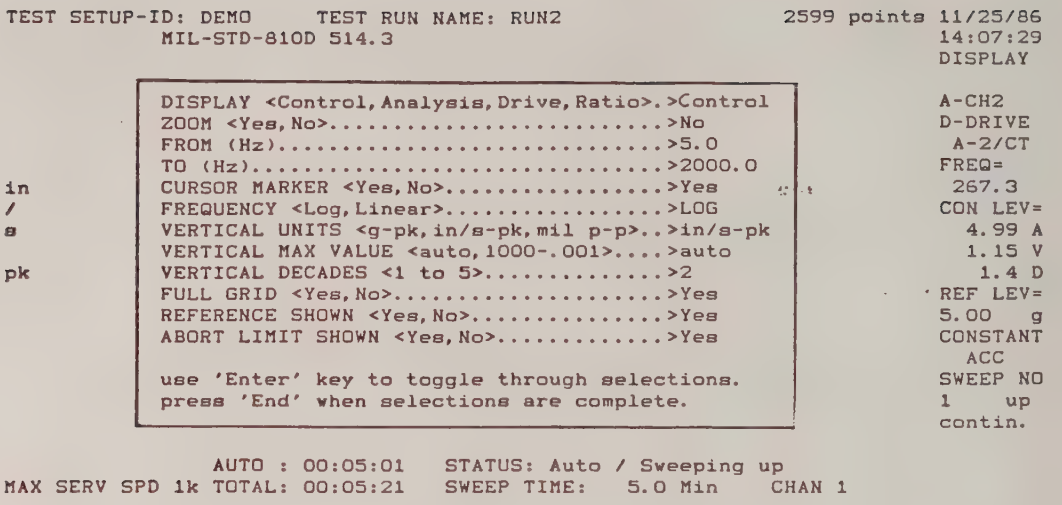


Fig. 5-13

Pressing (END) reconfigures Fig. 5-9 to Fig. 5-14, shown below. Note that the grid and reference velocity have been reinserted.

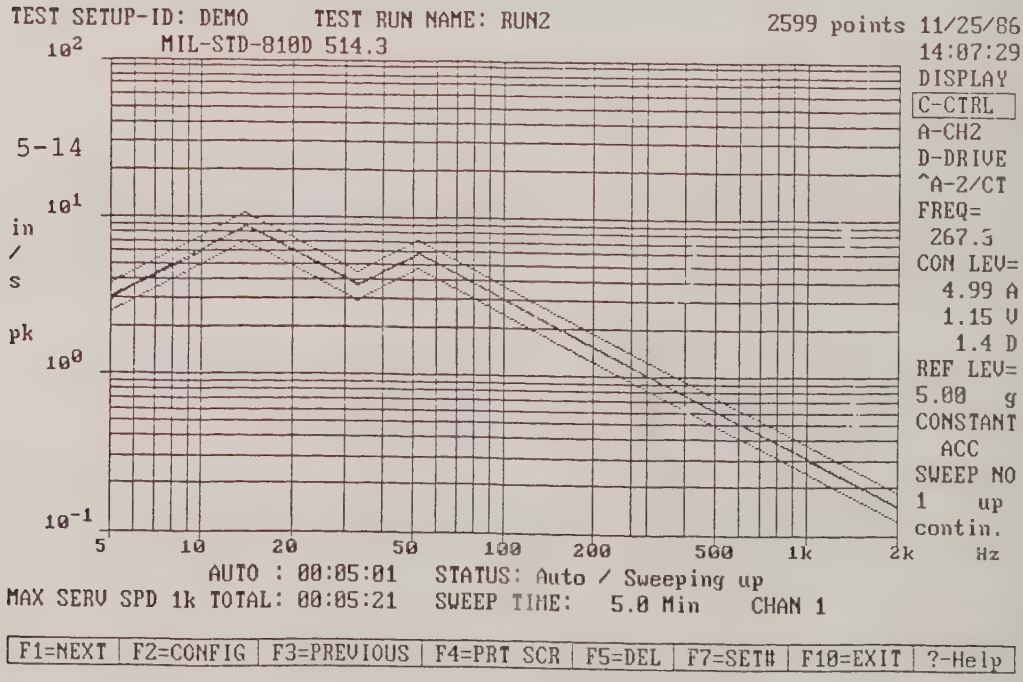


Fig. 5-14

5.5 Summary

All data saves that are initiated by the response to the SAVE TEST DATA ? query at the beginning of each test run (See Fig. 5-1) are accomplished when the 400AT/s is in the AUTO mode only. These automatic data saves are made only at the end of a sweep and include all data since the beginning of the sweep.

A data save made by a (F6) command in the middle of a sweep when the system is in the AUTO mode saves data only since the beginning of that sweep. When the system is in the MANUAL mode or the LOCAL mode, data can be saved only by the (F6) command, and then only if the graph has been configured to produce a cursor trace. The number of saved data points is limited to 4096 and data points are saved at an approximate rate of 6 per second if a frequency change is detected by the A-D converter.

6. COPYING OPERATIONS

Obtaining periodic copies on floppy disks of important test sequences, test setup information and saved test data from the system hard disk is an important part of system operation. This BACKUP operation can save many hours of reconstructive labor, should important information be inadvertently deleted from the hard disk. The complementary or RESTORE operation occurs when files on floppy disks are recopied to a system hard disk. The organization and techniques of making such copies are described in the remainder of this chapter.

Obtain the MAJOR OPERATIONAL MODES Menu below:

```
                    MAJOR OPERATIONAL MODES

F1 = RANDOM TEST                    F2 = REMOTE/LOCAL

F3 = SINE TEST                      F4 = MEASUREMENT/ANALYZE

F5 = SINE ON RANDOM TEST            F6 = MAINTENANCE/DIAGNOSTICS

F7 = SHOCK TEST                     F8 = HELP

F9 = RANDOM ON RANDOM TEST          F10 = EXIT

SELECT A FUNCTION KEY
```

Press (F6) to obtain the MAINTENANCE/DIAGNOSTICS Menu below:

```
                MAINTENANCE/DIAGNOSTICS      ver: 05/19/86 16:32:33

F1 = HARDWARE CONFIGURATION         F2 = ALTER ACCESS

F3 = SET DATE/TIME                  F4 = RUN DIAGNOSTICS

F5 = BACKUP                         F6 = RESTORE

F7 =                                F8 =

F9 =                                F10 = EXIT

SELECT A FUNCTION KEY
```

Press (F5) to obtain the BACKUP TYPE Menu found on p. 6-2.

The BACKUP TYPE Menu below lists the various types of test methods for which there may be stored information.

```
                        BACKUP TYPE

F1 = RANDOM                          F2 =

F3 = SINE                            F4 =

F5 =                                 F6 =

F7 =                                 F8 =

F9 =                                 F10 = EXIT TO PREVIOUS MENU
```

SELECT A FUNCTION KEY

Press (F1) to display the BACKUP RANDOM TESTS Menu below:

```
                     BACKUP RANDOM TESTS

F1 = TEST SEQUENCES                  F2 =

F3 = TEST SETUPS                     F4 =

F5 = TEST DATA                       F6 =

F7 =                                 F8 =

F9 =                                 F10 = EXIT TO PREVIOUS MENU
```

SELECT A FUNCTION KEY

?-Help

Press (Shift, ?) to obtain the HELP display on p.6-3. This menu describes the categories of information stored for RANDOM TESTS.

BACKUP/RESTORE

BACKUP copies information from the hard disk to the floppy disk.
RESTORE copies information from the floppy disk to the hard disk.

F1 - TEST SEQUENCES - Displays the Backup/Restore Test Sequences Menu, which provides a variety of copying modes for test sequences. Test sequences are not implemented for SINE or SHOCK testing. F1 is not active on the corresponding menu for those test types.

F3 - TEST SETUPS - Displays the Backup/Restore Test Setups Menu, which provides a variety of copying modes for test setups.

F5 - TEST DATA - Displays the Backup/Restore Test Data Menu, which provides a variety of copying modes for test data.

Esc - back to menu

This HELP display, and all following HELP displays, are common to both BACKUP and RESTORE operations for all types of tests. The menus for all BACKUP and RESTORE operations are identical except for the implied direction of the copying action. If (F6) had been chosen from the MAINTENANCE/DIAGNOSTICS Menu on p.6-1, all following menus would have had RESTORE instead of BACKUP in their titles.

Similarly, if (F3) had been chosen from the BACKUP TYPE Menu on p.6-2, then all following menus would relate to SINE vibration tests instead of RANDOM vibration tests.

For these reasons, the menus for the RESTORE and/or SINE choices, and also for other test types implemented in the future, will not be reproduced in the remainder of the chapter.

Press (Esc) to return to the BACKUP RANDOM TESTS Menu. Continue on p.6-4.

Press (F3) to display the BACKUP TEST SEQUENCES Menu below:

```
                        BACKUP TEST SEQUENCES

F1 = COPY ONE SEQUENCE AT A TIME          F2 = DISPLAY SEQUENCE IDS
                                                CHRONOLOGICALLY

F3 = COPY ALL SEQUENCES                   F4 = DISPLAY SEQUENCE IDS
                                                ALPHABETICALLY

F5 = COPY ALL SEQUENCES SINCE ____        F6 = PRINT SEQUENCE IDS
                                                CHRONOLOGICALLY

F7 =                                      F8 = PRINT SEQUENCE IDS
                                                ALPHABETICALLY

F9 =                                      F10 = EXIT TO PREVIOUS MENU

 SELECT A FUNCTION KEY

?-Help
```

Note that these operations relate to RANDOM tests only.

Press (Shift,?) to obtain the common HELP displays on p.6-5.

BACKUP/RESTORE TEST SEQUENCES MENU

Copying action is initiated by F1,F3, or F5. To help the operator decide on appropriate copying action, lists of all test sequence IDs are presented by F2,F4,F6 and F8, and the approximate number of sequences that may be stored on each disk.
After selecting either F1,F3 or F5, the operator must decide whether or not to copy all test setups listed by the sequence(s) he has decided to copy. A copy of the sequences merely provides a list of the test setup IDs associated with each sequence and not the test setup parameters. In order to include enough information to actually perform test sequences it is necessary to copy the test setups also.

F1 - COPY ONE SEQUENCE AT A TIME - Enter the appropriate test sequence ID, and respond to the additional question outlined above.

F3 - COPY ALL SEQUENCES - Respond to the additional question outlined above.

F5 - COPY ALL SEQUENCES SINCE _____ - Enter the appropriate date and respond to the additional question outlined above. This is valuable for periodic backup operations.

PgDn - to continue Esc - back to menu

Press (PgDn) for the final HELP display below:

BACKUP/RESTORE TEST SEQUENCES MENU

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10) to return to the BACKUP RANDOM TESTS Menu on p.6-2. Continue on p.6-6.

Press (F3) to obtain the BACKUP TEST SETUPS Menu below:

```
                        BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME              F2 = DISPLAY SETUP IDS
                                                 CHRONOLOGICALLY

F3 = COPY ALL SETUPS                       F4 = DISPLAY SETUP IDS
                                                 ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____            F6 = PRINT SETUP IDS
                                                 CHRONOLOGICALLY

F7 =                                       F8 = PRINT SETUP IDS
                                                 ALPHABETICALLY

F9 =                                       F10 = EXIT TO PREVIOUS MENU

  SELECT A FUNCTION KEY

?-Help
```

Press (Shift, ?) to obtain the HELP displays on p.6-7.

BACKUP/RESTORE TEST SETUP MENU

Copying action is initiated by F1,F3, or F5. To help the operator decide on appropriate copying action, lists of all test setup IDs are presented by F2,F4,F6 and F8, and the approximate number of setups that may be stored on each disk.
After selecting either F1,F3 or F5, the operator must decide whether or not to copy all test data associated with the test setups before actual copying is initiated.

F1 - COPY ONE SETUP AT A TIME - Enter the appropriate test setup ID, and respond to the additional question concerning test data.

F3 - COPY ALL SETUPS - Respond to the additional question concerning test data.

F5 - COPY ALL SETUPS SINCE _____ - Enter the appropriate date and respond to the additional question concerning test data. This is valuable for periodic backup operations.

PgDn - to continue Esc - back to menu

Press (PgDn) for the final HELP display below:

BACKUP/RESTORE TEST SETUP MENU

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10) to return to the BACKUP RANDOM TESTS Menu on p.6-2. Continue on p.6-8.

Press (F5) to obtain the BACKUP TEST DATA Menu below:

```
                        BACKUP TEST DATA

F1 = COPY DATA - ONE RUN AT A TIME      F2 = DISPLAY RUN NAMES
                                             IN CHRONOLOGICAL ORDER

F3 = COPY ALL TEST DATA                 F4 = DISPLAY RUN NAMES
                                             WITH ALPHABETICAL SETUP IDS

F5 = COPY ALL TEST DATA SINCE ____      F6 = PRINT RUN NAMES
                                             IN CHRONOLOGICAL   ORDER

F7 =                                    F8 = PRINT RUN NAMES
                                             WITH ALPHABETICAL SETUP IDS

F9 =                                    F10 = EXIT TO PREVIOUS MENU

 SELECT A FUNCTION KEY

?-Help
```

Press (Shift, ?) to obtain the HELP displays on p.6-9.

BACKUP/RESTORE TEST DATA MENU

Copying action is initiated by F1,F3, or F5. To help the operator decide on appropriate copying action, lists of all test setup IDs and the run names for saved data associated with them are presented by F2,F4,F6 and F8, and the approximate number of data saves that may be stored on each disk.

F1 - COPY ONE RUN NAME AT A TIME - Enter the appropriate test setup ID, and and the run name for the saved data. Note that the test setup ID is always necessary because run names for saved test data may be identical for two different test setups. After copying is completed, the request for another test setup ID and run name will be made.

F3 - COPY ALL TEST DATA - The copying of the entire collection of saved test data is initiated.

F5 - COPY ALL TEST DATA SINCE _____ - Enter the appropriate date (month/day/year). Test data saved since that date will be copied.

PgDn - to continue Esc - back to menu

Press (PgDn) to obtain the final HELP display below:

BACKUP/RESTORE TEST DATA MENU

If a floppy disk fills up in the middle of copying a group of files (BACKUP action), the operator is asked to insert a new disk and the copying action will continue after a prompt to format or not to format. Formatting initializes a disk and destroys all data on the disk. New disks need to be formatted before they can be used.

F2 & F6 - DISPLAY/PRINT RUN NAMES IN CHRONOLOGICAL ORDER - The run names along with the associated test setup IDs are displayed or printed in order according to the dates the data was saved.

F4 & F8 - DISPLAY/PRINT RUN NAMES WITH ALPHABETICAL SETUP IDS - The run names for saved data are displayed/printed with the associated test setup IDs and the test setup IDs are sorted in alphabetical order. Dates for the run names are also listed.

PgUp - back up one screen Esc - back to menu

Press (Esc), then (F10) to return to the BACKUP RANDOM TESTS Menu on p.6-2.

The basic excursion through the menus for the BACKUP operation is now complete. You may, however, want to EXIT to the MAINTENANCE/ DIAGNOSTICS Menu on p.6-1 and explore similar paths for the RESTORE operation to satisfy yourself of the properties noted on p.6-3.

The remainder of the chapter gives an example of an actual copying operation.

A floppy disk was inserted in the front slot of the Host Computer, and the locking handle rotated vertically. The BACKUP RANDOM TESTS Menu shown on p.6-2 was obtained. By pressing (F3), the BACKUP TEST SETUPS Menu was displayed. To aid in the BACKUP operation, the list of the saved TEST SETUPS shown below was obtained by pressing (F6).

Note the estimate for available space on both disks at the bottom of the printout. If the floppy disk had not been inserted initially, room available for "0" test setups on the floppy disk would have been reported.

```
    TEST SETUP                DATE      TIME
 1  DEMOTEST                  05/20/86  12:56:57
 2  FLATTEST                  05/14/86  10:27:14
 3  AIRPAX                    05/02/86  11:09:28
 4  FLAT                      05/01/86  13:58:44
 5  GE                        04/29/86  12:59:29
 6  BOEING                    04/24/86  11:00:53
 7  SINE                      04/21/86  07:33:22
 8  250TEST                   04/14/86  13:39:07
 9  625TEST                   04/14/86  13:22:14
10  1250TEST                  04/14/86  12:10:59
11  BENCHMAR                  04/03/86  09:56:30
12  HUGHES2                   03/17/86  13:18:47
13  CHRYSLER                  03/17/86  09:24:09
14  SPERRY                    02/19/86  04:10:57
15  M2022142                  01/22/86  15:41:23
16  M2022141                  01/22/86  15:40:51
17  RAYTHEON                  01/09/86  20:02:31
ROOM AVAILABLE FOR 3064 TEST SETUPS ON HARD DISK
ROOM AVAILABLE FOR 73 TEST SETUPS ON FLOPPY DISK
```

Next, the decision to press (F5 = COPY ALL SETUPS SINCE ---) was made to illustrate how a periodic BACKUP operation might be started. Upon pressing (F5), the date query appeared below the Menu as shown on p.6-11.

```
                    BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME          F2 = DISPLAY SETUP IDS
                                            CHRONOLOGICALLY

F3 = COPY ALL SETUPS                   F4 = DISPLAY SETUP IDS
                                            ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____        F6 = PRINT SETUP IDS
                                            CHRONOLOGICALLY

F7 =                                   F8 = PRINT SETUP IDS
                                            ALPHABETICALLY

F9 =                                   F10 = EXIT TO PREVIOUS MENU

COPY ALL SETUPS SINCE DATE (mm/dd/yy) : 04/16/86
ALSO COPY ALL TEST DATA ASSOCIATED WITH THE SETUP(S)? (Y,N) : N

    Esc (Back to Menu)      Enter (Accepts Entry)
```

The date 04/16/86 was entered and the query concerning copying all related test data appeared. An "N" (No) response was entered. During the copying action, the test setup being copied appears at the bottom of the display. The display shown below occurred while the "GE" test setup was being copied.

```
                    BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME          F2 = DISPLAY SETUP IDS
                                            CHRONOLOGICALLY

F3 = COPY ALL SETUPS                   F4 = DISPLAY SETUP IDS
                                            ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____        F6 = PRINT SETUP IDS
                                            CHRONOLOGICALLY

F7 =                                   F8 = PRINT SETUP IDS
                                            ALPHABETICALLY

F9 =                                   F10 = EXIT TO PREVIOUS MENU

COPY ALL SETUPS SINCE DATE (mm/dd/yy) : 04/16/86

COPYING SETUP GE
    Esc (Back to Menu)      Enter (Accepts Entry)
```

At the end of the BACKUP operation the display shown below appears. The number of files copied appears at the bottom of the display, and agrees with the number expected from the TEST SETUP list shown on p.6-10 and the entry date 4/16/86.

```
                        BACKUP TEST SETUPS

F1 = COPY ONE SETUP AT A TIME              F2 = DISPLAY SETUP IDS
                                                 CHRONOLOGICALLY

F3 = COPY ALL SETUPS                       F4 = DISPLAY SETUP IDS
                                                 ALPHABETICALLY

F5 = COPY ALL SETUPS SINCE ____            F6 = PRINT SETUP IDS
                                                 CHRONOLOGICALLY

F7 =                                       F8 = PRINT SETUP IDS
                                                 ALPHABETICALLY

F9 =                                       F10 = EXIT TO PREVIOUS MENU

  SELECT A FUNCTION KEY

COPY COMPLETE - 7 FILES BACKED UP
?-Help
```

After the "COPY COMPLETE" message is displayed and the red LED near the floppy insert slot is OUT, the floppy disk may be removed from the Host. When the red LED is ON, the floppy disk should not be disturbed.

When the copying is initiated after the response to the TEST DATA query shown on p.6-11 is entered, the statement and query shown below often appears just below the Menu. See HELP display on p.6-7. The decision to format the disk by entering "Y" will usually cause the copying action described earlier to be completed.

```
CAN'T CREATE BACKUP FILE. FLOPPY DISK MAY NEED TO BE FORMATTED (INITIALIZED)
OR MAY BE OF WRONG TYPE. FORMATTING DESTROYS ALL DATA ON THE DISK.
FORMAT DISK? (Y,N) : Y

    Esc (Back to Menu)       Enter (Accepts Entry)
```

Some problem, however, may prevent the formatting from being carried out. In this case the message shown below appears below the Menu.

```
DISK CAN'T BE USED. INSERT A NEW ONE AND PRESS ANY KEY TO CONTINUE
```

7. CHECKOUT - CALIBRATION

7.1 Preliminary Preparation

Sections 7.3 through 7.11 constitute a simple but reasonably complete checkout procedure that can be adapted for periodic calibration purposes. Before the checkout procedures are begun, the UD340, System Host, Video Monitor and Line Printer should be connected as described in Section 2.2 . It is not necessary or desirable to connect the signal inputs of the UD340 to charge amplifiers or connect the signal outputs to the power amplifier and remainder of the VTS as outlined in Section 2.3, however.

The 400AT/S should be placed so that it is possible to remove both top and bottom covers from the UD340, thus exposing the card adjustments from the top of the chassis and the connector terminals from the bottom of the chassis. Place the UD340 on its side so that both the card adjustments and connector terminal are accessible without repositioning the UD340. Figure 7-1 shows the locations of the card adjustments.

IF IT IS NECESSARY TO REMOVE OR REINSERT A CARD FROM THE UD340 DURING THE CALIBRATION/CHECKOUT PROCEDURE, TURN OFF THE AC POWER TO THE 400AT/S (Host, Accessories and UD340) BEFORE REMOVING OR REINSERTING THE CARD.

The Sine Test Setup (CALSINE) shown in Figure 7-2 provides a basis for calibration and checkout measurements found later in this chapter.

The following instruments are necessary for various parts of the calibration procedure. Model suggestions are also included.

Oscilloscope..... (CRO).....Hewlett-Packard 1202B
4-1/2 Digit Multimeter.. (DMM).....(AC response to 5 Hz)
Universal Counter..... (UC) .....Hewlett-Packard 5325B
Ratio Transformer..... (RT) .....Ailtech RT-20R
Sinusoidal Oscillator... (OSC).....Krohn-Hite 4100R

7.2 LOCAL Mode

The initial calibration procedures are performed with open loop operation using the UD340 in the LOCAL Mode. Proceed to run the CALSINE Test Setup shown in Figure 7-2 and switch the UD340 from the KEYBOARD to the LOCAL Mode when the prompt "Use function keys to continue" appears below the test graph. Make sure that OUTPUT is in the RESET position, when switching from KEYBOARD to LOCAL.

7.3 Sweep Oscillator

7.3.1 Monitor OSC OUT with the CRO and UC.
Monitor LIN FREQ with the DMM (DC Voltage).
Also observe the frequency readings displayed by the UD340 (FM) and the Video Monitor.

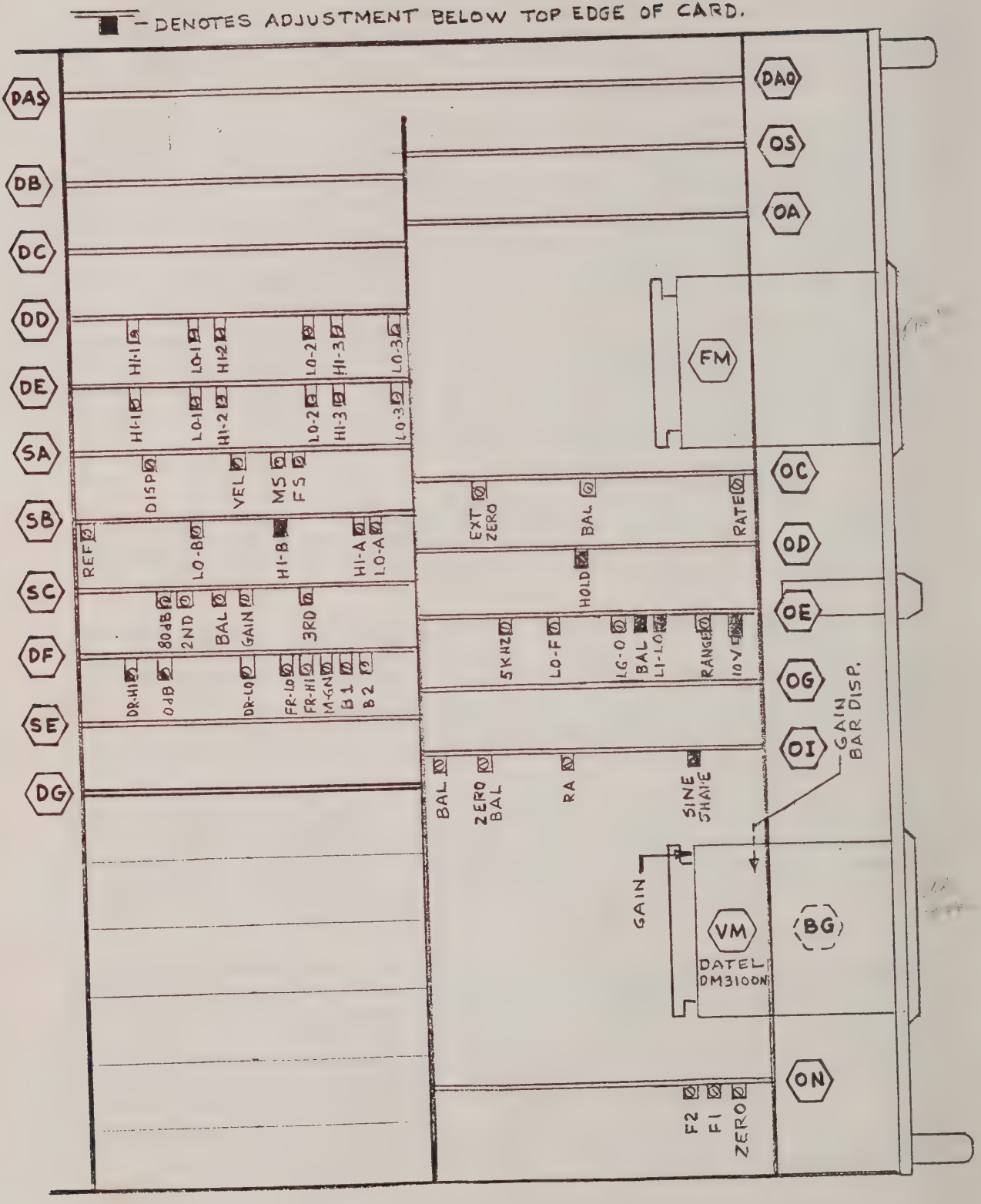


Fig. 7-1

TOP VIEW OF UD340 SHOWING CARD ADJUSTMENT LOCATIONS

Fig. 7-2

SINE TEST SETUP

TEST SETUP ID : CALSINE LAST CHANGED: 02/18/87 13:09:16

TEST DESCRIPTION : FOR CAL/CHECKOUT OF UD340 SINE CONTROL AND 400AT/S

TEST TYPE : .....)1
(1=LOG SWEEP, 2=LINEAR SWEEP, 3=DISCRETE FREQUENCIES)

NUMBER OF SWEEPS : .....)0
(0=CONTINUOUS, 1 to 9999)

MAXIMUM SERVO SPEED : .....)4
(1=100dB/sec, 2=300dB/sec, 3=1k dB/sec, 4=3k dB/sec)

CONTROL CHANNEL INPUT SEQUENCE.)1, , , , , , ,
(N=CHN FOR N=1-8)

LOWER FREQUENCY LIMIT (Hz) : ..)5

UPPER FREQUENCY LIMIT (Hz) : ..)5000

SWEEP TIME (Min) : .....)1

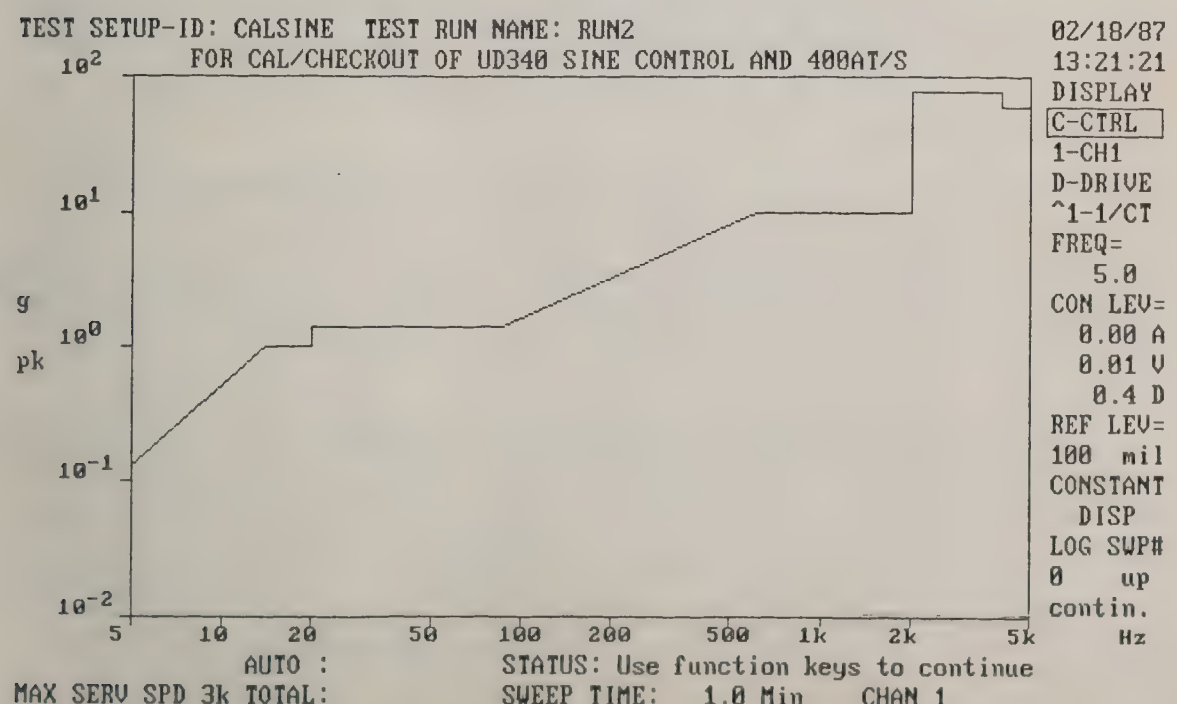
SWEEP RATE (Oct/min) : .....)9.97

STARTING SWEEP DIRECTION : ....)1
(1=UP, 2=DOWN)

STARTING FREQUENCY (Hz) : .....)5

SETUP ID : CALSINE PROGRAM TABLE

SEGMENT NO.	FREQUENCY (Hz)	FUNCTION (D,A,V)	LEVEL (mil pk-pk)	LEVEL (g-pk)	LEVEL (in/s-pk)	ALARM (+%)	ALARM (-%)	ABORT (+%)	ABORT (-%)
1	5	D	100	0.13	1.57	50	40	60	50
2	13.98	A	100	1	4.39	50	40	60	50
3	20	A	68.91	1.41	4.33	32	24	40	30
4	86.64	V	3.67	1.41	1	32	24	40	30
5	614.5	A	0.52	10	1	32	24	40	30
6	2000	A	0.39	80	2.46	20	24	24	30
7	4000	A	0.07	60	0.92	32	24	40	30
8	5000		0.05	60	0.74	32	24	40	30



7.3.2 Adjust COARSE and FINE (FREQ) to establish the DC voltage monitored at LIN FREQ in Table 7.1. Observe the frequencies and make the adjustments listed if necessary.

LIN FREQ (DC)	UC		FM	Video	Monitor
	Hz	Adjust	Hz	Hz	Adjust
10.00 V ±.01	5000±5	OE-5 kHz (±1 Hz)	UC±1	5000±50	DF-FREQ. HI (Flashes±8 Hz)
10.0 mV ±0.5	LIN FREQ/2 ±.1(~5 Hz)	OE-LO F (±.05 Hz)	UC±1	UC±.01	DF-FREQ. LO

Table 7.1 Frequency Calibration

Setting the 10 mV exactly may be a little difficult manually in the 5 Hz calibration row. Close agreement of the Video Monitor frequency with the actual frequency (UC) is necessary, since values shown on the velocity and displacement displays are calculated from the acceleration and frequency readings. Consequently any frequency error results in Video Monitor display errors for velocity and displacement.

7.3.3 Repeat the measurements/adjustments in Table 7.1.

7.3.4 Monitor OSC OUT with the DMM (AC voltage).
At 500 Hz the voltage should be 1.00 ± 2%.
Adjust OI-GAIN if necessary.
At 5 Hz and 5000 Hz, the voltage should be slightly lower.

7.3.5 Observe the waveform as the frequency is changed manually. If there is any observable distortion, or if there is any other reason to suspect drive voltage distortion, consult Sections 7.12 and 7.14.

7.4 Log Sweep

7.4.1 Monitor terminal OE-6 with the DMM (DC Voltage).
Monitor OSC OUT with the CRO and UC.

7.4.2 Adjust the COARSE and FINE controls to obtain the voltages listed in Table 7.2 at OE-6. Corresponding measured frequencies and adjustment locations are also given.

OE-6 (DC)	UC Freq. (Hz)	Adjust
10.000 ±.001 VDC	5000±5	OE-BAL (±1 Hz)
5.005 ±.001 VDC	158.1±1.0	OE-RANGE (±.2 Hz)
10 ± 1mVDC	5.0±0.1	OE-LOG ZERO (±.05Hz)

Table 7.2 Log Sweep Calibration

7.4.3 Repeat the measurements/adjustments in Table 7.2 sequentially.

7.4.5 Monitor LOG FREQ with the DMM (DC voltage). Table 7.3 gives acceptable values of LOG FREQ output as a function of measured frequency.

UC Freq. (Hz)	LOG FREQ (VDC)	TOLERANCE
5.0	0	±4 mV
50.0	.400	±4 mV
500	.800	±4 mV
5000	1.200	±4 mV

Table 7.3 LOG FREQ Output

7.5 Drive Voltage

7.5.1 Monitor SINE DRIVE OUT with CRO and DMM (AC voltage). Turn OUTPUT to MAX and adjust frequency to 500 Hz. The DMM reading should be 9.1 +0.1 V rms. If out of tolerance, change ADJ MAX OUT on rear panel of UD340 or adjust SC-GAIN.

7.5.2 Enter (D) on Keyboard to observe the drive voltage on the Video Monitor. The displayed value should agree with the DMM value ±1%. Adjust DF-DRIVE HI if necessary.

7.5.3 The bar graph DRIVE VOLTAGE (dB) should read 0 dB and start to read lower values as OUTPUT is turned CCW slowly. If necessary, adjust DF-0dB so that bar display just indicates 0dB when OUTPUT is at MAX position.

7.5.4 Turn OUTPUT CCW until DMM measures 10-15 mV rms. The Drive Voltage reading on Video Monitor should agree. Adjust DF-DRIVE LO if necessary. Repeat 7.5.2 and 7.5.4. DRIVE VOLTAGE (dB) should indicate approximately -60 dB.

7.6 Charge Amplifier

7.6.1 For calibration of the charge amplifier, as well as the acceleration velocity and displacement readings, it is convenient to set up the circuit in Figure 7-3 to provide precision calibration voltages.

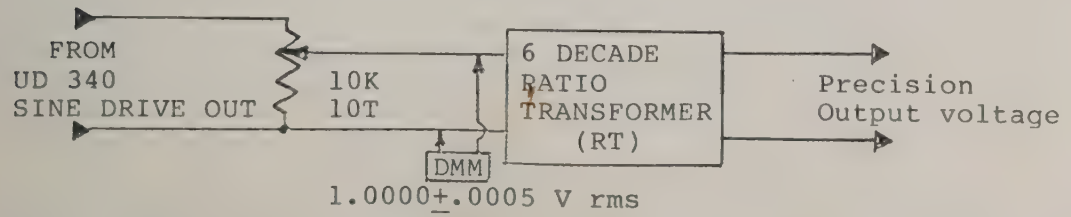


Fig. 7-3 Precision AC Voltage Source

With 1.0000 V rms set at the input to the RT, the setting of the RT determines the precision voltage required. The 10 kilohm-10 turn potentiometer is used as a vernier to obtain 1.000 V rms easily from the signal source. Only the upper 5 or 10 percent of the potentiometer is used to minimize the output impedance of the signal source.

7.6.2 Apply the precision voltages in Table 7.4 below at 500 Hz in series with a 1000 pF ± 1/2% capacitor to CHG. IN. The oscillator voltage may be obtained from the SINE DRIVE OUT connector of the UD340.

A shielding box should surround the capacitor. In the LOCAL Mode adjust OUTPUT to give slightly more than 1.0 V rms to the setup in Figure 7-3. Monitor the voltage at 10 mV/g OUT with a DMM (AC Voltage) and CRO.

7.6.3 Table 7.4 gives the measured voltage at 10 mV/g OUT for several conditions. Approximate adjiustments on the SA card are shown and should be repeated after adjustments.

SENS pc/g	RANGE	INPUT TO 1000 pF Cap.	10 mV/g OUT	ADJUST
10	1-10	1.000 V	1.000+0.1%	SA-FS
1	1-10	.100 V	1.000±0.5%	SA-MS
10 (1 T)	10-100	1.000 V	1.000±1.0%	Change 9000pF

Table 7.4 Charge Amplifier Calibration

7.7 Acceleration Calibration - Vibration Meter and Video Monitor

7.7.1 With the UD340 in the LOCAL Mode, type (C) for the Video Monitor to display the Control Acceleration. Put the shorting cap on the INPUT-1 connector. The VIBRATION METER (VM) should read 000.0 ±0.1g. If necessary adjust DF-B1 and DF-B2 sequentially so that the voltage at DF-TP1 is 0±20 mV DC and the VM reads 000.0g.

7.7.2 Table 7.5 shows the voltages applied to INPUT-1 and the measurements and adjustments necessary to calibrate the Vibration Meter and the acceleration display on the Video Monitor. The voltage source can be obtained from the SINE DRIVE OUT and applied through the arrangement in Fig. 7-3. Terminal DD-6 is monitored with the DMM (DC voltage). The adjustments HI3 and LO3 are done and repeated sequentially if necessary to establish the correct readings on the Video Monitor and to determine the corresponding DC voltages at terminal DD-6 (Readings A and B).

INPUT-1 (mV rms)	FREQ (Hz)	VIBRATION METER (g-pk)	ADJUST	VIDEO MONITOR (g-pk)	DD-6 to DD-11 (DCV)	ADJUST
707.1	50	100.0±.2	DF-METER GAIN	100.00±.2	A(~2V)	DD-HI3
70.71	50	10.0±.1	See 7.7.1	10.00±.05	B(~.2V)	DD-LO3
63.64	50	9.0±.1	See 7.7.1	9.00±.01	0.9xA	DD-HI2
7.071	50	1.0±.1	See 7.7.1	1.00±.01	B	DD-LO2
6.364	20	0.9±.1	See 7.7.1	.90±.01	0.9xA	DD-HI1
.707	20	0.1±.1	See 7.7.1	.10±.01	B	DD-LO1

Table 7.5 Calibration of DD amd DE Cards
Control Channel Display

The adjustments for the pairs HI2, LO2 and HI1, LO1, are each done and repeated sequentially until the readings A and B are obtained ±.1%. The Video Monitor display should agree with the values in the table after this is accomplished.

7.7.3 The Video Monitor display for the Monitor Channel is controlled by the DE card. Type (1) to obtain the display for the Monitor Channel. Adjust HI3, LO3, HI1, LO2, HI1 and LO1 for the DE card in the same fashion as those controls were adjusted on the DD card in 7.7.2. The DC voltage is monitored at terminal DE-6.

7.8 Velocity and Displacement Calibration

7.8.1 A sinusoidal voltage source is applied to INPUT-1 as in Fig. 7-3. The frequency is monitored at OSC OUT by the UC. The UD340 is again in the LOCAL mode. Press DISP to read displacement on the UD340 vibration meter, and press VEL to read velocity.

7.8.2 Table 7.6 gives voltage applied at INPUT 1, input frequencies, corresponding readings on the Vibration Meter, and applicable adjustments. Readings and tolerances for the display are also given. Type (C) if necessary to display the Control input parameters. It is necessary to set input frequency accurately (±0.1%) to preserve measurement accuracy for velocity and displacement.

Excessive errors in velocity and/or displacement measurement at 5 Hz may be due to improper operation of the tracking high-pass filter on card SB (See Section 7.14), or improper values of the resistors marked ** on card SA.

INPUT mv rms	FREQ (Hz)	UD340 VM	TOL.	ADJ.	VIDEO MON.	TOL.
460.6	40.0	100.0 in/s-pk	±1%	SA-VEL	100.0	±1%
578.8	40.0	1000. mil p-p	±1%	SA-DISP	1000.	±1%
57.57	5.00	100.0 in/s-pk	±2%	See text	100.0	±2%
9.043	5.00	1000. mil p-p	±3%	See text	1000.	±3%

Table 7.6 Velocity and Displacement Calibration

The values of velocity and displacement as displayed on the Video Monitor should track the values on the Vibration Meter with reasonable accuracy (±1%). If the values do not compare favorably, check that the frequency displayed on the Video Monitor agrees closely with that measured by the UC (See Section 7.3).

Go back to auto mode on the Calsine test (with Foom ~~Key~~ Local to keyboard)

7.9 Reference Level - Closed Loop Control

7.9.1 Provide closed-loop operation by applying the SINE DRIVE OUT to the input of the 10 kohm 10 turn potentiometer shown in Figure 7-3, and apply the voltage at the arm of the potentiometer to INPUT-1. Set the potentiometer at 1 turn CW (gain = 0.1). Do not include the RT in the setup.

7.9.2 Run the CALSINE test. The setup is found in Figure 7-2. Press F9 (Auto Hold) at various points throughout the program and check the value of the control variable on the vibration meter and the Video Monitor display. Suggestions for the CALSINE test include the points in Table 7.7 below.

APPROX FREQ (Hz)	5	12	15	100	500	1000	3000	4500
IDEAL CONTROL LEVEL	100 mil p-p	100 mil p-p	1.00 g-pk	10.0 in/s pk	10.0 in/s pk	10.0 g-pk	80.0 g-pk	60.0 g-pk
TOLERANCE	+3%	+2%	±1%	±2%	±2%	±1%	±1%	±1%

Table 7.7 Ideal Control Levels (From Fig. 7-2)

7.9.3 Should any tolerances be exceeded, repeat the 1000 Hz point in Table 7.7 and adjust SB-REF for a reading of 10.00 g pk ±0.1% and repeat all readings. Any readings out-of-tolerance following the adjustment are probably due to variatons or errors from earlier calibration procedures (Sections 7.4, 7.7, 7.8).

7.10 Sweep Time

7.10.1 Edit the entry for NUMBER of SWEEPS for the CALSINE Test Setup found in Fig. 7-2 to read

NUMBER OF SWEEPS .....>1

Provide closed loop operation with the 10K ohm, 10 turn potentiometer as in Section 7.9.

7.10.2 Sweep HOLD - Run the CALSINE test, and allow the frequency to sweep near 1 kHz. Press F1 (Abort) when the frequency is approximately 1 kHz. Monitor the measured frequency. The drift in the HOLD mode should be less than 2.5 Hz/min or less than 2.5%/min for frequencies less than 100 Hz. Adjust OD-HOLD for minimum drift at 1000 Hz. Do not use (F9) to provide the HOLD action.

7.10.3 Run the CALSINE test. The test should begin at 5 Hz and finish automatically after one upsweep at 5 kHz. The AUTO test timeclock should read 00:01:00 ±1 sec. Adjust OC-RATE if necessary.

7.10.4 Edit the following entries for CALSINE as shown below:

STARTING SWEEP DIRECTION . . . . .>2
STARTING FREQUENCY . . . . . .>5000

Run the edited CALSINE test. The test should begin at 5 kHz and finish automatically after one downsweep at 5 Hz. The AUTO test time clock should read 00:01:00 ±1 sec. Normally no adjustment should be required. The nominal 221 K resistor near OC-TP1 has been set at the factory.

7.10.5 Edit the entry for SWEEP TIME to provide a sweep of 10 minutes or longer. Rerun the CALSINE test as in 7.10.3 and 7.10.4 to provide a single upsweep and then a single downsweep. The AUTO test time clock measures the sweep time in each case. If the upsweep time is not within ±2% tolerance adjust OC-EXT ZERO. One turn CW increases the upsweep and downsweep time approximately 0.5%. Following this, the downsweep time may be adjusted by OC-BAL. One turn CW increases the downsweep time by about 0.5%.

7.11 Servo Speed

7.11.1 Edit the entries for the CALSINE Test Setup to restore the test as given in Fig. 7-2. Make sure that continuous sweeps are provided. Prepare to run the test in closedloop fashion as described in 7.9.1. Monitor INPUT-1 with the CRO, and prepare to view the envelope of the control voltage.

7.11.2 Run the CALSINE test and allow the frequency to sweep to the vicinity of 4 kHz. Press (F7) repeatedly to reverse the sweep and cause the transition at 4 kHz from 60g to 80g and vice versa to occur. The observed control voltage envelope should look like Fig. 7-4.

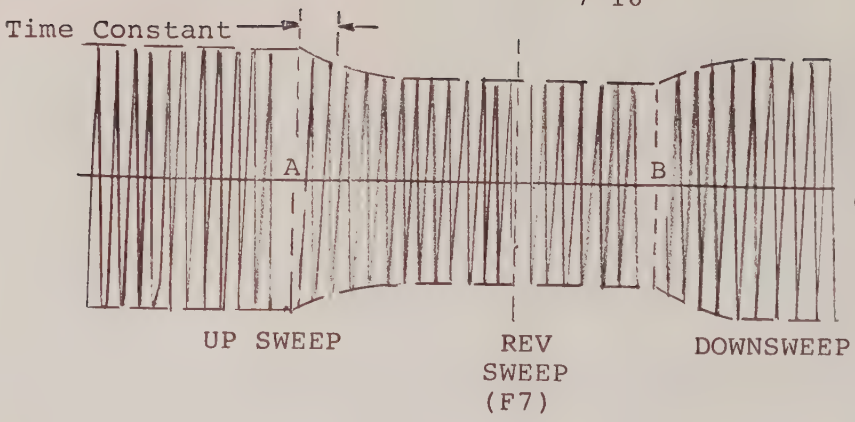


Fig. 7-4

Envelope of Control Signal

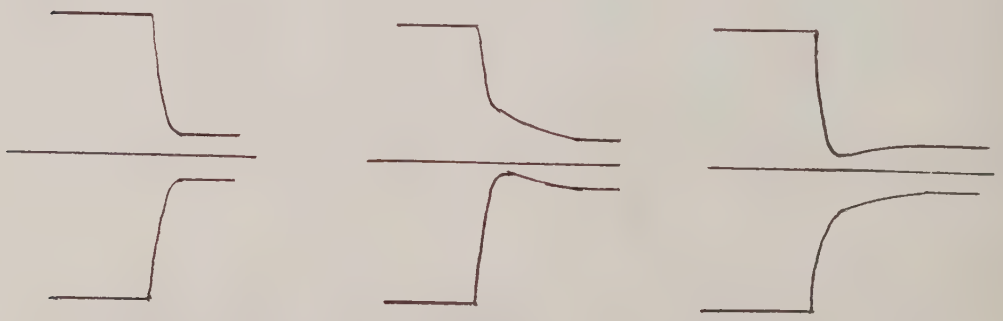
7.11.3 The time constant for the signal envelope changes at A and B in Fig. 7-4 should be 4±2 msec. The CRO time base should be about 5 ms/cm. Control signal envelope time constants (for small changes) are related to servo speed (dB/s) by the following relationship:

$$\text{Time constant (ms)} = 10^4 / \text{Servo speed(dB/s)}$$

7.11.4 Allow the frequency to sweep to the vicinity of 20 Hz and then press (F7) repeatedly to reverse the sweep and cause the transition from 1.41 g to 10 g and vice versa to occur. Adjust the CRO time base to display the signal envelope (time base about .5s/cm).

7.11.5 The time constant for the signal envelope changes should be 500 ±200 ms. Consult Section 7.13 if either measurement is out of tolerance.

7.11.6 AGC Balance - Allow the frequency to sweep to the vicinity of 1 kHz and observe the signal envelope as (F7) is used to trigger the transition from 80g to 10g and vice versa. Refer to Fig. 7-5 for the transition from 80g to 10g.



Control Signal Envelopes

Fig. 7-5 AGC Balance

The transition to 10g should be centered on the CRO baseline as shown in the CORRECT version of Fig. 7-5 Adjustment of SC-BAL should center the 10g trace of either of the INCORRECT versions of Fig. 7-5.

THE FOLLOWING SECTIONS DESCRIBE PROCEDURES THAT ARE NOT NORMALLY PART OF ROUTINE CHECKOUT AND CALIBRATION PROCEDURES. DO NOT ATTEMPT THESE IF THERE IS NO INDICATION OF UNSATISFACTORY PERFORMANCE. Those potentiometer adjustments not included in Sections 7.1 through 7.11 are discussed in the following sections.

7.12 Harmonic Distortion

7.12.1 Distortion Analyzer - In addition to the instruments suggested earlier, an audio distortion analyzer, or a FFT spectrum analyzer is also required. For audio distortion analyzers, the Krohn-Hite Models 6880 and 6900, and the Hewlett Packard Model 8903 are suggested.

7.12.2 Operate the UD340 in the LOCAL Mode.
Monitor OSC OUT with the CRO and Distortion Analyzer.

7.12.3 At 300 Hz adjust OI-BAL to provide minimum 2nd harmonic distortion. Then adjust OI-SINE SHAPE to provide minimum 3rd harmonic distortion. Adjustment of OI-ZERO BAL insures that the zero level stairsteps for both positive and negative halves of the sinusoid are the same. It affects 2nd harmonic distortion slightly, but not nearly so much as OI-BAL. Typically the minimum distortion at 300 Hz is 0.05% and the maximum allowable value is 0.3%.

7.12.4 At 5 kHz the maximum harmonic distortion is 0.5% and the typical measured value is 0.15 - 0.20%. The capacitor marked ** on the OI card minimizes delay unbalance and 2nd harmonic distortion at 5 kHz. It is factory-selected and does not usually need to be changed.

7.12.5 Monitor SINE DRIVE OUT with the CRO and Distortion Analyzer. Provide closed-loop operation as in Section 7.9.1. Run the CALSINE test and allow the frequency to sweep to about 650 Hz and press (F9), causing the frequency to remain constant.

7.12.6 Measure the harmonic distortion. Typically the value is 0.1% with a maximum of 0.3%. If necessary, adjust SB-2nd and SB-3rd to minimize 2nd and 3rd harmonic distortion respectively. The voltage at SINE DRIVE OUT should be about 0.7V rms. These adjustments affect maximum output and AGC balance so it may be necessary to repeat Section 7.5.1 (SC-BAL).

7.12.7 Press F1 (Abort). Adjust SC-80dB until signal component disappears at SINE DRIVE OUT and wideband noise remains.

7.13 Servo Speed Adjustment

7.13.1 Remove AC power from the UD340.
Remove the SB card (AGC Control) and place it on an extender.
Remove Z8(DG 200) from the SB card.
Remove the SC card (AGC Amp) from the UD340.
Reapply AC power to the UD340, and put the UD340 in the LOCAL mode from the CALTEST setup.

7.13.2 Monitor the resistance between SB-TP2 and SB-TP3 with the DMM. Make sure both input terminals to the DMM are floating (not connected to signal reference).

7.13.3 Set the frequency to 5 kHz and adjust SB-HI-B so that measured resistance is 3.3k ±10%. Set the frequency to 5 Hz and adjust SB-LO-B so that measured resistance is 1.0M ±20%. Repeat these two steps. The relationship between measured resistance and servo speed is

$$\text{SERVO SPEED (dB/s)} = 10^7/\text{Resistance (ohms)}$$

7.13.4 Remove AC power from UD340, replace Z8, return SC card to the UD340, and return SB card directly to the internal connector. Reapply AC power to the UD340.

7.14 Tracking High-Pass Filter

7.14.1 Remove AC power from the UD340.
Remove the SA card (Chg. Converter).
Apply 1.0V rms from an external oscillator to terminal SB-6.
Monitor the output from SB-7 with a CRO and DMM (AC voltage).
Reapply AC power and put the UD340 in the LOCAL mode.

7.14.2 Table 7.8 gives measurements, and adjustments for various values of the external oscillator frequency and the frequency of the UD340.

EXT. OSC. FREQ. (Hz)	SB-6 INPUT V rms	UD340 FREQ. (Hz)	SB-7 OUTPUT V rms	ADJUST
500	1.0	1500	.7-.8	SB-HI-A
5	1.0	15	.7-.8	SB-LO-A

Table 7.8 Calibration of Tracking Hi-Pass Filter

Repeat the measurements and adjustments in Table 7.8.

7.14.3 For equal settings of the frequencies of the external oscillator and the UD340 at 5, 15, 150, and 500 Hz check that the output voltage at SB-7 (input at SB-6=1.0V) does not vary from a median value of 1.00 ±3% V rms by more than ±1%. If the above tolerances cannot be met, the EVR's (V1, V2 and V3) are not matched well enough. Consult factory.

7.14.4 Remove AC power from the UD340.
Replace the SA card. Reapply power to the UD340.

7.15 Tracking Low-Pass Filter

Should the OSC OUT voltage not remain constant (±6%) in amplitude over the 3 decade range in 7.3.4, or if 32nd harmonic stair-step distortion is noticed, the adjustments on the ON card (Tracking Low-Pass Filter) should be checked. If replacement of the EVR's (electrically-variable-resistors) is indicated, purchase a matched set from the factory.

7.15.1 Observe AC power precautions as before.
Remove the OI-card (Sine Generator).
Connect an external sine oscillator to terminal ON-17.
Monitor ON-TP1 with a CRO and DMM (AC voltage).
Adjust the external oscillator for 1.00 V rms.
Put the UD340 in the LOCAL mode.

7.15.2 ON-F1 (Flatness). Set the UD340 frequency at 100 Hz. Sweep the external oscillator frequency and note the response at TP1. For an external frequency of 150 Hz adjust ON-F1 for 1.0V rms at ON-TP1.

7.15.3 ON-ZERO. Set the UD340 frequency at 10 Hz and the external oscillator at 30 Hz. Adjust ON-ZERO for 0.71 V rms at TP1.

7.15.4 ON-F2 (Flatness). Monitor ON-18 with the CRO and DMM (AC voltage). Set UD340 frequency at 100 Hz. Sweep the external oscillator frequency and note decrease in response at high frequencies. For an external oscillator frequency of 125 Hz adjust ON-F2 for 1.0 V rms.

7.15.5 Remove the external oscillator, observe AC power precautions and replace OI card. Sweep UD340 frequency from 5 Hz to 5 kHz. There should be no visible 32F stair-step distortion and the voltage at OSC OUT should be constant ±5%.

7.16 LINEAR SWEEP

7.16.1 Edit the CALSINE Test Setup for the following line items to provide a linear sweep:

TEST TYPE .....>2

Begin the CALSINE test and switch to LOCAL mode as in Section 7.2.

7.16.2 Vary the COARSE and FINE controls to provide nearly 10.0 mVDC at terminal OE-6. Monitor voltage at OE-21 and adjust OE-LIN LO to provide the same voltage measured at OE-6 ±0.1mV.

7.16.3 Change the COARSE and FINE controls to provide 10.000VDC at OE-6. The voltage at OE-21 should be 10.000 ± .002VDC.

7.16.4 It may be necessary to repeat Section 7.4 if OE-LIN LO is readjusted.

7.17 Vibration Meter and Drive Voltage (0dB)

The VM-GAIN and BG-GAIN controls need not be readjusted since they duplicate the functions of the DF-METER GAIN and DF-Odb adjustments respectively.

7.18 Power Supply Voltages

Table 7.9 lists all power supply voltages and other voltages on the OPS and SPS cards.All measurements are relative to signal or logic reference and are useful prior to any general trouble-shooting procedure.

LOCATION	VOLTAGE (VDC)	RIPPLE
OPS-1 (11)	15.5 ±.2	max 10 mv pp
OPS-2 (11)	-15.5 ±.2	max 10 mv pp
OPS-22 (12)	5.0 ±.3	max 50 mv pp
OPS-TP1	+9.0 to +11.7 VDC	typ 0.7 v pp
OPS-TP2	-22.8 to -28.0 VDC	typ 1.2 v pp
OPS-TP3	+22.8 TO +28.5 VDC	typ 1.2 V pp
SPS-1	+15.5 ±.2	max 10 mv pp
SPS-2	-15.5 ±.2	max 10 mv pp
SPS-22	+5.0 ±.3	max 50 mv pp
SPS-TP1	+7.8 to +10.4 VDC	typ 1.1 v pp
SPS-TP2	-22.0 to -27.8 VDC	typ 1.8 v pp
SPS-TP3	+22.0 to +27.5 VDC	typ 2.0 v pp
OE-8 (11)	10.06 ± .04	2 mv pp

Table 7.9 Power Supply Voltages

7.19 Sweep Frequency Limits - DASCON 1

7.19.1 The adjustments that control the accuracy of the LOWER and UPPER FREQUENCY LIMITS are found on the Metrabyte DASCON 1 card , which is installed on the Host Computer. Remove the cover of the Host Computer to expose the DASCON 1 card (associated with connector slot 7). Refer to Fig. 9.1 in the DASCON 1 Manual for location of the user calibration adjustments.

7.19.2 Initiate the CALSINE test but do not attempt to start the sweep with the F3 Function Key. Monitor the OSC OUT with the UC. The measured starting frequency should be 5.00 ±.05 Hz (for upsweep). Adjust DACØ ZERO ADJ (on DASCON 1).

7.19.3 Edit the CALSINE Test Setup to provide a starting frequency of 4000 Hz (for upsweep)

STARTING SWEEP DIRECTION .....>1
STARTING FREQUENCY (Hz) .....>4000

Initiate the CALSINE test but do not attempt to start the sweep. The measured frequency at OSC OUT should be 4000±4 Hz. Adjust DACØ F.S. ADJ.

7.19.4 Repeat 7.19.2 and 7.19.3.

7.19.5 Edit the CALSINE Test Setup to provide a starting frequency of 10 Hz (for downsweep)

STARTING SWEEP DIRECTION .....>2
STARTING FREQUENCY (Hz).....>10

Initiate the test as before. The measured frequency should be 10.00 ±.05 Hz. Adjust DAC 1 ZERO ADJ.

7.19.6 Edit the CALSINE Test Setup to provide a starting frequency of 5 kHz (for downsweep)

STARTING SWEEP DIRECTION .....>2
STARTING FREQUENCY (HZ).....>5000

Initiate the test as before. The measured frequency should be 5000 ±5 Hz. Adjust DAC 1 F.S. ADJ.

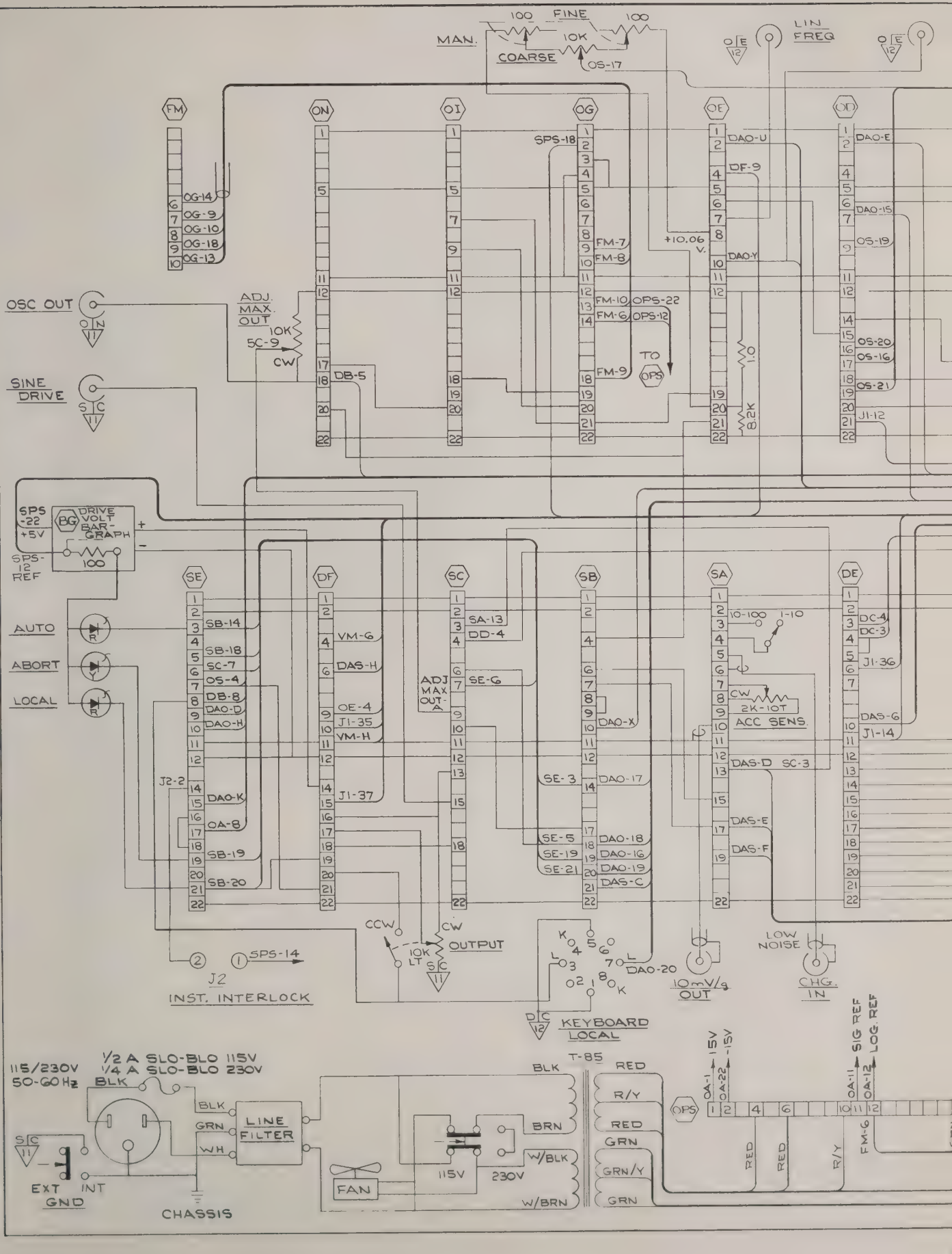
7.19.7 Repeat 7.19.5 and 7.19.6. Replace cover on Host Computer.

8. CIRCUIT SCHEMATICS - LAYOUTS

Figure	Title	Dwg. No.	Rev.
8.1	UD340 Chassis Wiring Schematic	D20200	
8.2	DAS-DAO Interface Card - Schematic	D20476	
8.3	DAS-DAO Interface Card - Layout	D20207	
8.4	DB - 8 Channel Multiplexer - Schematic	C20480	
8.5	DB - 8 Channel Multiplexer - Layout	A20208	
8.6	DC - 8 Channel Monitor - Schematic	C20204	
8.7	DC - 8 Channel Monitor - Layout	A20209	
8.8	DD, DE - Tri AC-DC Converter - Schematic	C20495	
8.9	DD, DE - Tri AC-DC Converter - Layout	A20474	
8.10	SA - Charge Amp - Integrator - Schematic	C13737	C
8.11	SA - Charge Amp - Integrator - Layout	B13722	B
8.12	SB - AGC Control - Schematic	C13738	G
8.13	SG - AGC Control - Layout	D13714	C
8.14	SC - AGC Amplifier - Schematic	C20201	
8.15	SC - AGC Amplifier - Layout	B13720	D
8.16	DF - Local/Keyboard/Meter - Schematic	C20478	
8.17	DF - Local/Keyboard/Meter - Layout	A20206	
8.18	SE - Mode Control - Schematic	C13740	A
8.19	SE - Mode Control - Layout	B13716	B
8.20	OS - Oscillator Mode Control - Schematic	B9371	A
8.21	OS - Oscillator Mode Control - Layout	B9370	A
8.22	OA - Sweep Light Control - Schematic	B20202	
8.23	OA - Sweep Light Control - Layout	B20203	
8.24	OC - Sweep Speed Control- Schematic	B20210	
8.25	OC - Sweep Speed Control - Layout	A9298	C
8.26	OD - Sweep Generator - Schematic	C9296	G

Circuit Schematics - Layouts

8.27	OD - Sweep Generator - Layout	A9299	J
8.28	OE - Log Conv/Hi Freq Gen - Schematic	B20481	
8.29	OE - Log Conv/Hi Freq Gen - Layout	B20482	
8.30	OG - Freq Div/Counter Cont - Schematic	C12259	
8.31	OG - Freq Div/Counter Cont - Layout	D12258	
8.32	OI - Sine Generator - Schematic	C9284	B
8.33	OI - Sine Generator - Layout	C9286	C
8.34	ON - Tracking Low-Pass - Schematic	B9321	B
8.35	ON - Tracking Low-Pass - Layout	A9322	D
8.36	FM - Frequency Meter - Schematic	B13803	A
8.37	FM - Frequency Meter - Layout	A13880	
8.38	BG - Bar Display - Schematic	A19122	
8.39	BG - Bar Display - Layout	A19	
8.40	OPS, SPS Power Supply - Schematic	B13819	A
8.41	OPS, SPS Power Supply - Layout	B13724	C
8.42	DG - S/R Selector - Schematic	A20212	
8.43	DG - S/R Selector - Layout	A20213	


MAN.
100 FINE
10K
100
COARSE
OS-17
LIN FREQ
FM
ON
OI
OG
OE
OD
OG-14
OG-9
OG-10
OG-18
OG-13
SPS-18
DAO-U
DF-9
DAO-Y
+10.06 V.
FM-7
FM-8
FM-10
OPS-22
FM-6
OPS-12
FM-9
TO OPS
DAO-E
DAO-15
OS-19
OS-20
OS-16
OS-21
J1-12
1.0
8.2K
OSC OUT
ADJ. MAX. OUT
10K
5C-9
CW
DB-5
SINE DRIVE
SPS -22 +5V
BG
DRIVE VOLT BAR-GRAPH
100
SPS-12 REF
AUTO
ABORT
LOCAL
SE
DF
SC
SB
SA
DE
SB-14
SB-18
SC-7
OS-4
DB-8
DAO-D
DAO-H
J2-2
DAO-K
OA-8
SB-19
SB-20
VM-G
DAS-H
OE-4
J1-35
VM-H
J1-37
SA-13
DD-4
ADJ MAX OUT A
SE-G
SE-3
DAO-17
SE-5
DAO-18
SE-19
DAO-16
SE-21
DAO-19
DAS-C
DAO-X
10-100
1-10
CW
2K-10T
ACC SENS.
DAS-D
SC-3
DAS-E
DAS-F
DC-4
DC-3
J1-36
DAS-6
J1-14
CCW
CW
10K LT
OUTPUT
SPS-14
J2
INST. INTERLOCK
DAO-20
10mV/g OUT
LOW NOISE
CHG. IN
DIC
KEYBOARD LOCAL
115/230V 50-60Hz
1/2 A SLO-BLO 115V
1/4 A SLO-BLO 230V
BLK
GRN
WH
LINE FILTER
EXT GND
INT
CHASSIS
FAN
T-85
115V
230V
BLK
BRN
W/BLK
W/BRN
RED
R/Y
RED
GRN
GRN/Y
GRN
OPS
0A-1
0A-22
-15V
+15V
SIG REF
LOG. REF
0A-11
0A-12
FM-6
RED
RED
R/Y

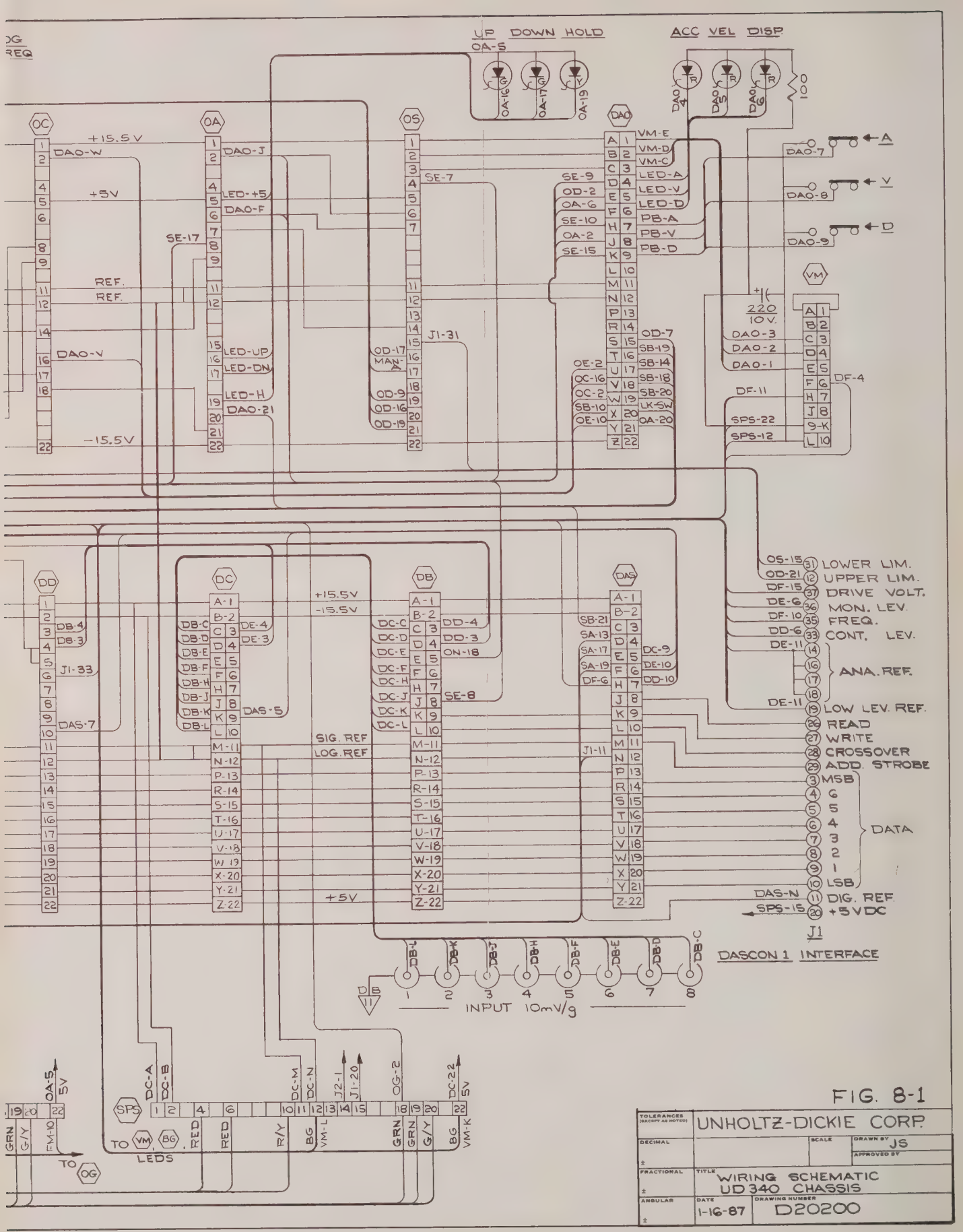
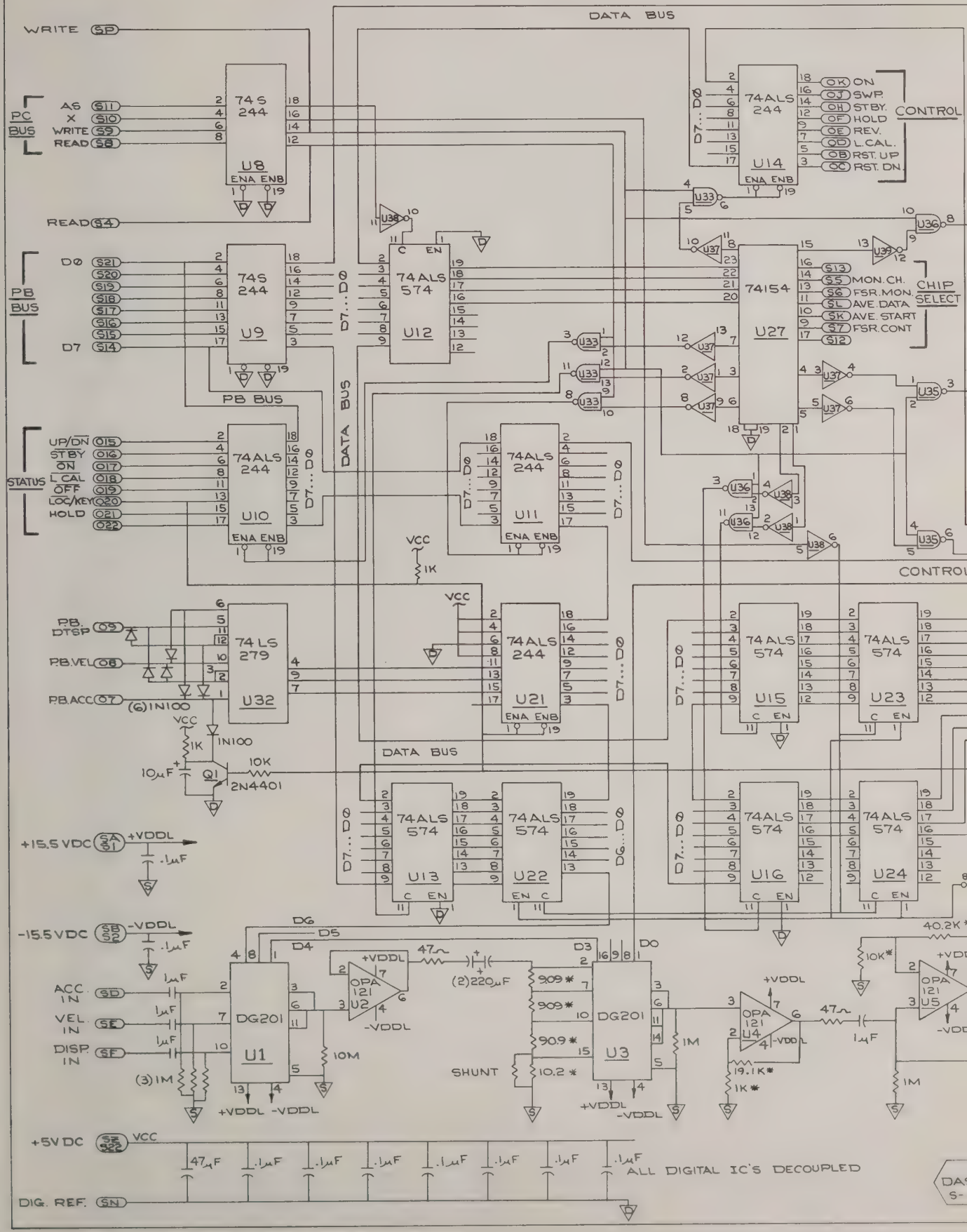
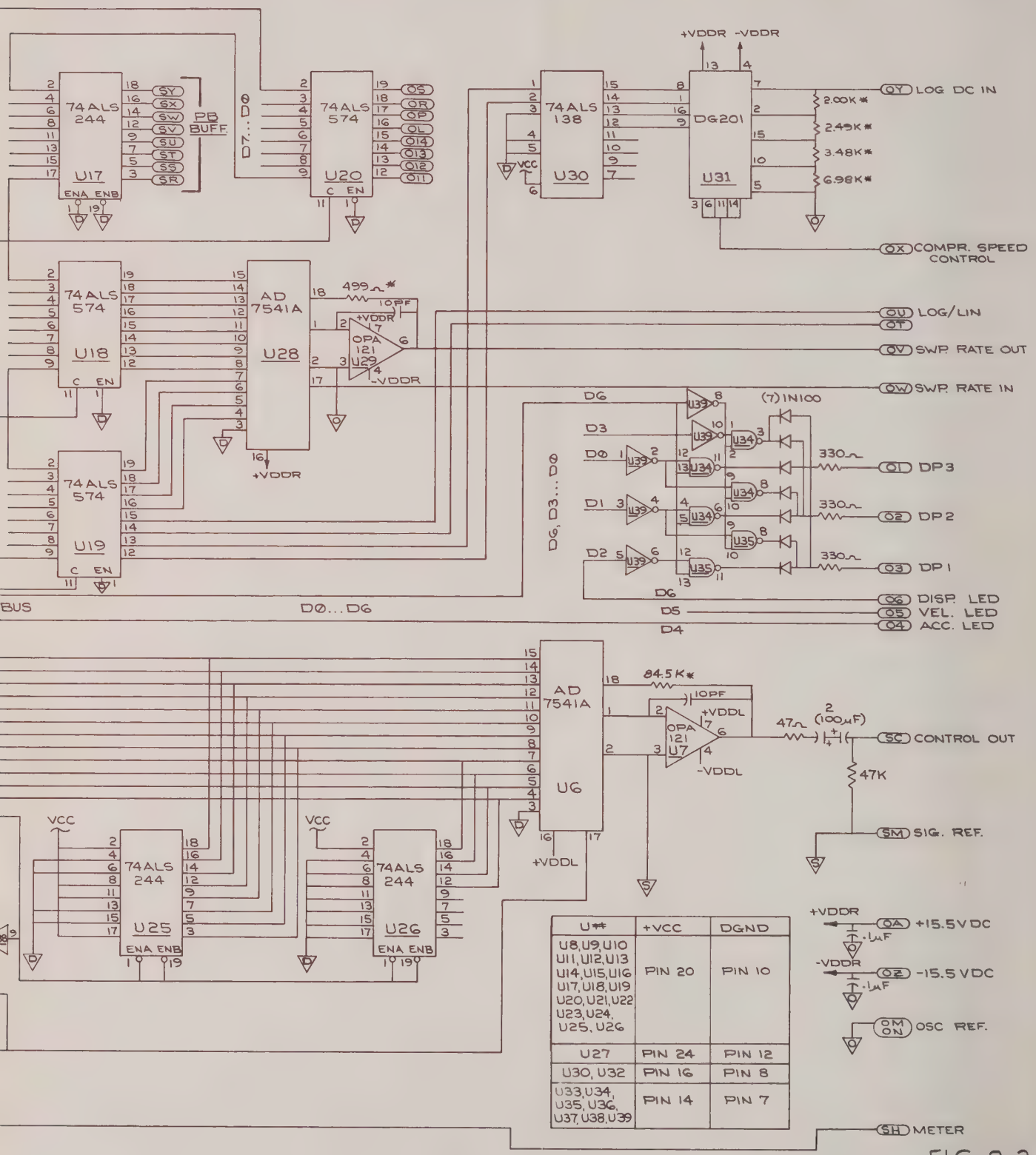


FIG. 8-1

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±		SCALE	DRAWN BY JS
			APPROVED BY
FRACTIONAL ±	TITLE WIRING SCHEMATIC UD 340 CHASSIS		
ANGULAR ±	DATE 1-16-87	DRAWING NUMBER D20200	


DATA BUS
WRITE S9
PC BUS
AS S11
X S10
WRITE S9
READ S8
U8
74S 244
ENA ENB
READ S4
PB BUS
D0 S21
S20
S19
S18
S17
S16
S15
D7 S14
U9
74S 244
PB BUS
U12
74ALS 574
D7...D0
DATA BUS
U14
74ALS 244
OK ON
OJ SWP.
OH STBY.
OF HOLD
OE REV.
OD L.CAL.
OB RST. UP
OC RST. DN.
CONTROL
U27
74154
S13
S5 MON. CH.
S6 FSR. MON.
SL AVE. DATA
SK AVE. START
S7 FSR. CONT
S12
CHIP SELECT
STATUS
UP/DN O15
STBY O16
ON O17
L. CAL O18
OFF O19
LOC/KEY O20
HOLD O21
O22
U10
74ALS 244
U11
74ALS 244
VCC
1K
U21
74ALS 244
P.B. DTSP O9
P.B. VEL O8
P.B. ACC O7
U32
74LS 279
(6) 1N100
1N100
10µF
Q1
2N4401
10K
U15
74ALS 574
U23
74ALS 574
U13
74ALS 574
U22
74ALS 574
U16
74ALS 574
U24
74ALS 574
+15.5 VDC S A S1
+VDDL
.1µF
-15.5 VDC S B S2
-VDDL
ACC IN S D
VEL IN S E
DISP IN S F
1µF
DG201
U1
(3) 1M
10M
D6
D5
D4
D3
D0
+VDDL
47Ω
(2) 220µF
OPA 121 U2
-VDDL
9.09 *
9.09 *
90.9 *
10.2 *
SHUNT
DG201
U3
1M
OPA 121 U4
19.1K *
1K *
47Ω
1µF
40.2K *
10K *
OPA 121 U5
1M
+5V DC S Z S22
VCC
47µF
.1µF
ALL DIGITAL IC'S DECOUPLED
DIG. REF. SN



U#	+VCC	DGND
U8, U9, U10 U11, U12, U13 U14, U15, U16 U17, U18, U19 U20, U21, U22 U23, U24, U25, U26	PIN 20	PIN 10
U27	PIN 24	PIN 12
U30, U32	PIN 16	PIN 8
U33, U34, U35, U36, U37, U38, U39	PIN 14	PIN 7

FIG. 8-2

* 1% METAL FILM - RN55

U33 - U36 74ALS 00
U37 - U39 74ALS 04

DIG - REF.
SIG - REF
OSC - REF.

TOLERANCES (UNLESS AS NOTED)	UNHOLTZ-DICKIE CORP.
DECIMAL ±	SCALE — DRAWN BY JS — APPROVED BY
FRACTIONAL ±	TITLE: UD 340 INTERFACE BOARD
ANGULAR ±	DATE 12-27-86 — DRAWING NUMBER D20476

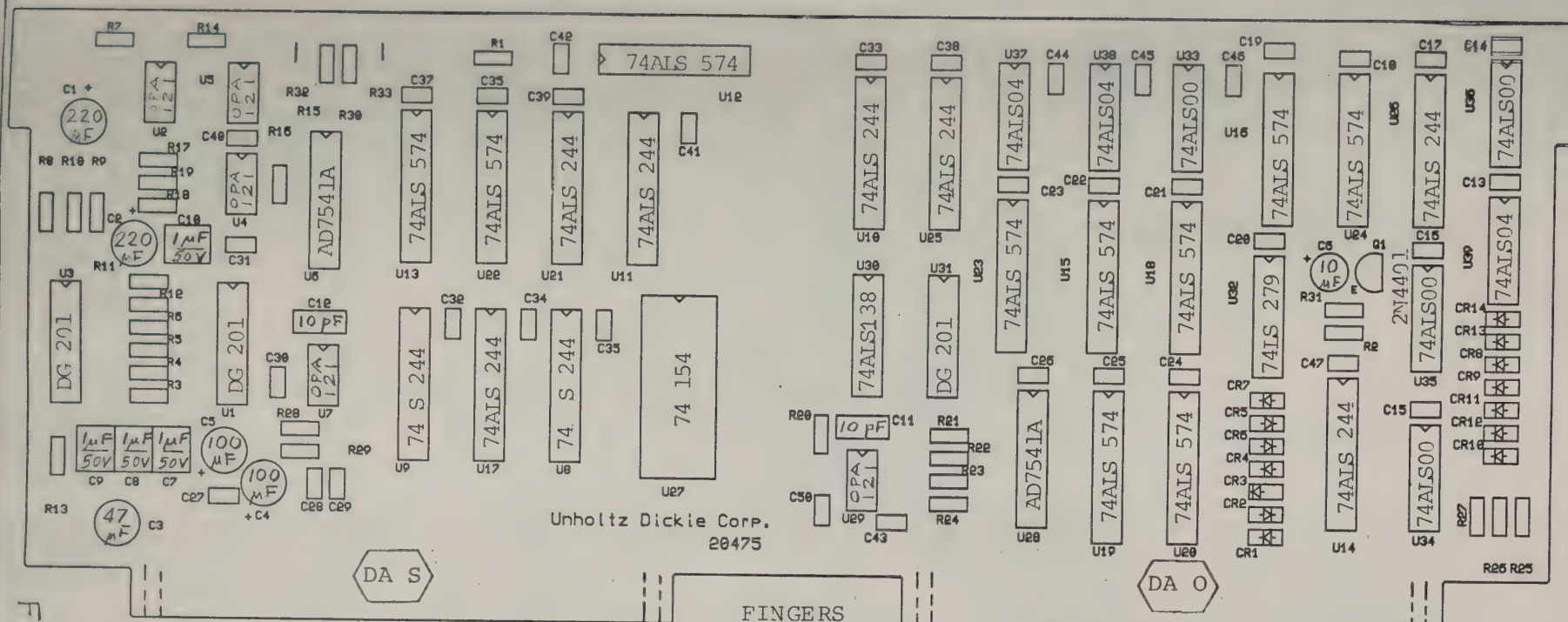


FIG 8.3

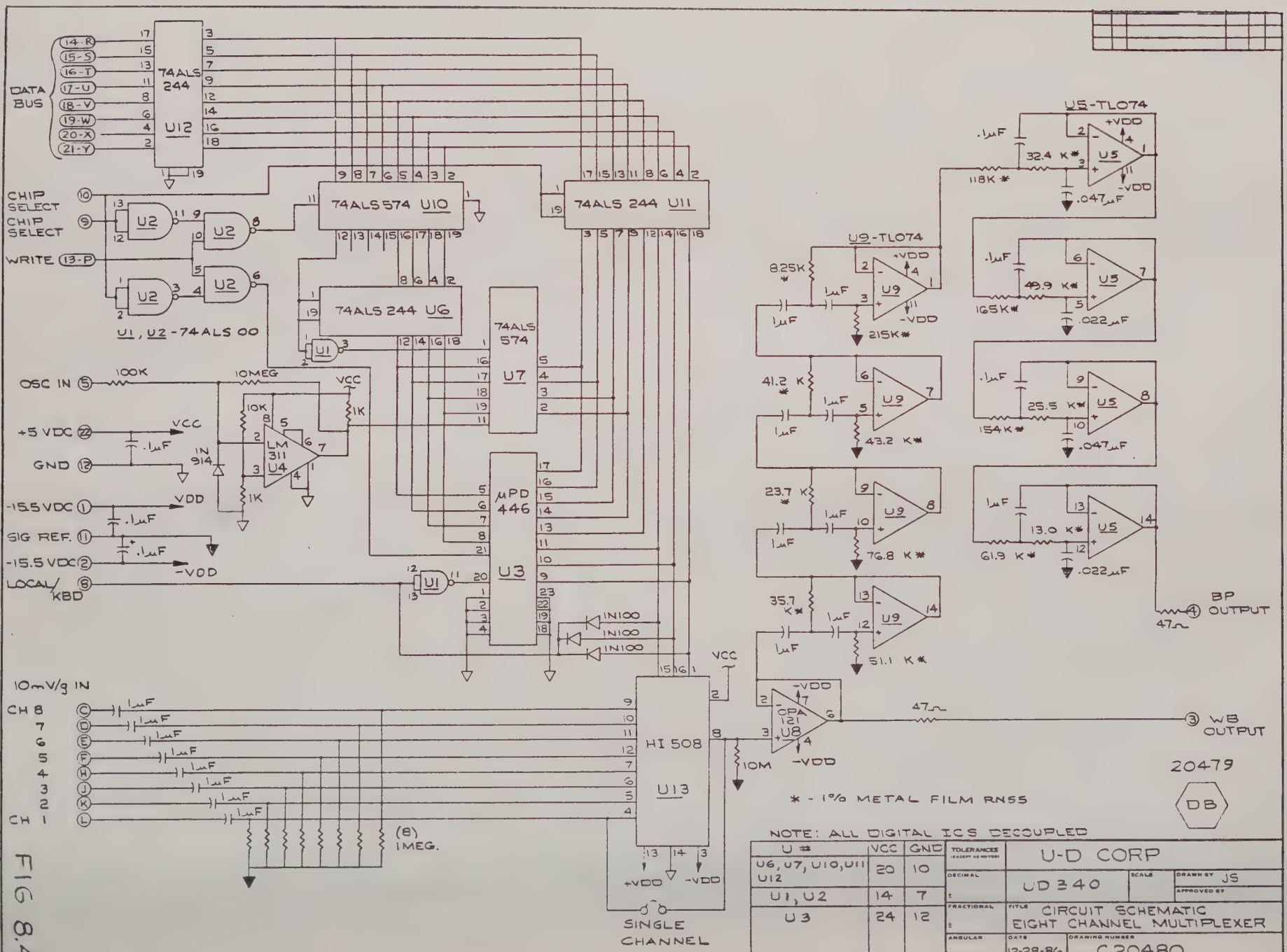
R1	1.0 K	R13	1.0 M	R25	330
R2	10 K	R14	1.00K *	R26	330
R3	1.0 M	R15	19.1K *	R27	330
R4	1.0 M	R16	47	R28	47
R5	1.0 M	R17	10.0K *	R29	47 K
R6	10 M	R18	1.0 M	R30	84.5K *
R7	47	R19	40.2K *	R31	1.0 K
R8	9.09K *	R20	499 *	R32	0
R9	909 *	R21	2.00K *	R33	0
R10	90.9 *	R22	2.49K *	C13 thru C50	0.1 µF 20V
R11	10.2 *	R23	3.48K *		
R12	1.00K *	R24	6.98K *		

ALL DIODES (CR1--CR14) --- 1N100

* - 1% METAL FILM RN55 RESISTORS

DAS DAO

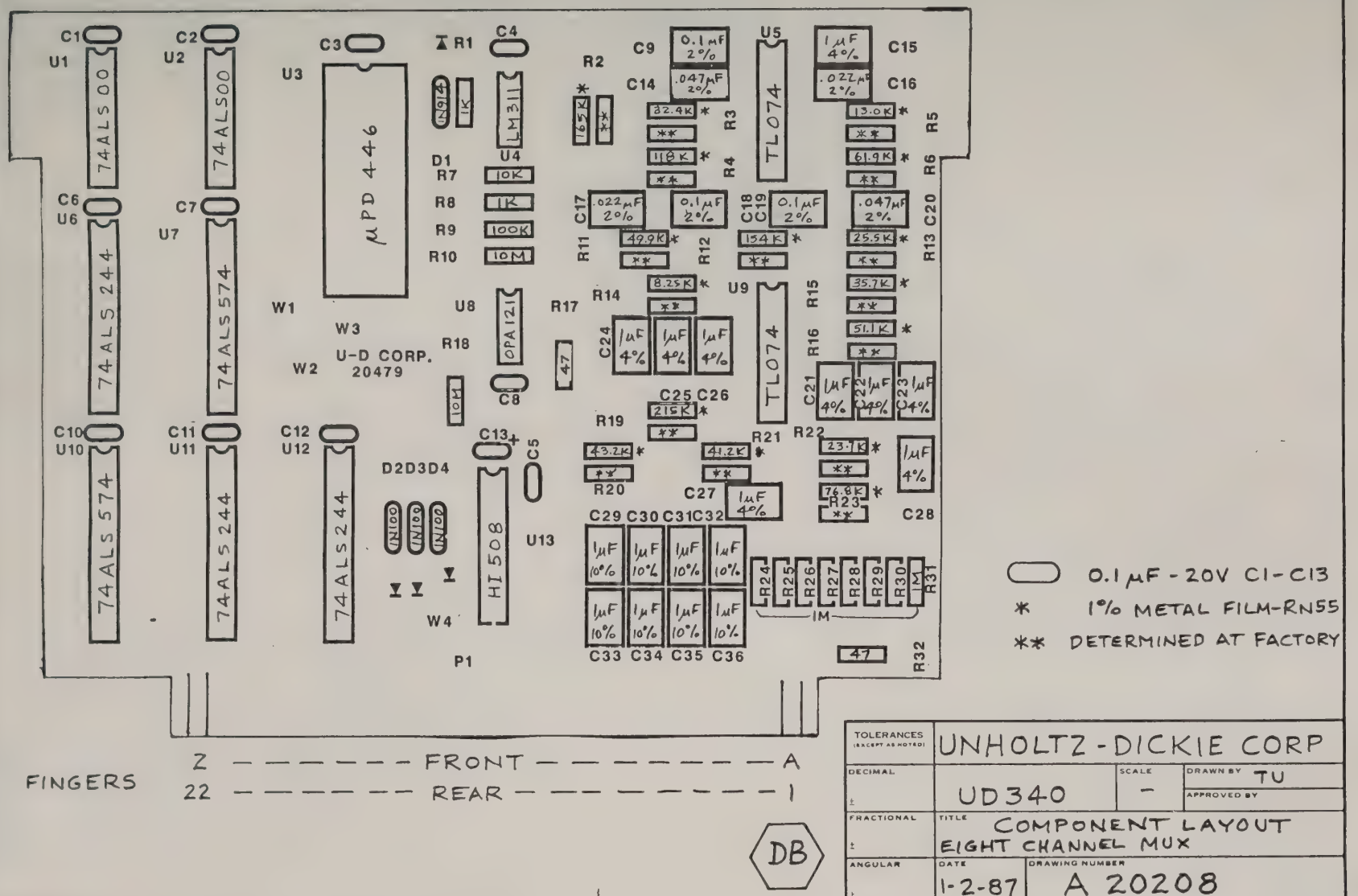
TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORPORATION		
DECIMAL ±	UD340	SCALE	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE: LAYOUT- INTERFACE CARD		
ANGULAR ±	DATE: 12/86	DRAWING NUMBER: A20207	



U #	VCC	GND
U6, U7, U10, U11 U12	20	10
U1, U2	14	7
U3	24	12

TOLERANCES	U-D CORP
DECIMAL	UD340
FRACTIONAL	TITLE CIRCUIT SCHEMATIC EIGHT CHANNEL MULTIPLEXER
ANGULAR	DATE 12-28-86 DRAWING NUMBER C20480
SCALE	DRAWN BY JS
	APPROVED BY

FIG 8.4



TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD340	SCALE –	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT EIGHT CHANNEL MUX		
ANGULAR ±	DATE 1-2-87	DRAWING NUMBER A 20208	

MADE IN U.S.A.

FIG. 8.5

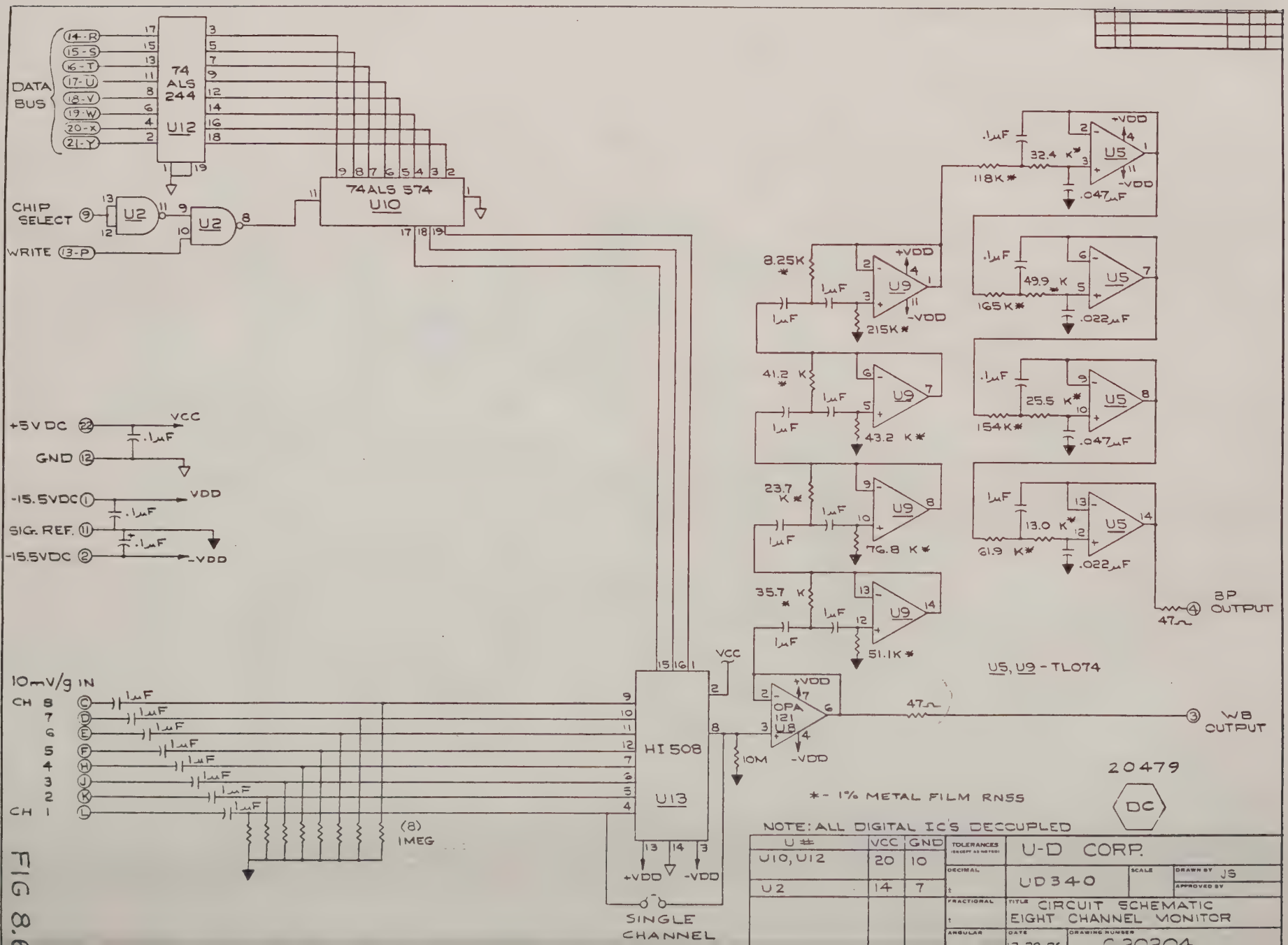

DATA BUS
14-R
15-S
16-T
17-U
18-V
19-W
20-X
21-Y
74 ALS 244
U12
CHIP SELECT
WRITE
13-P
U2
74ALS 574
U10
+5VDC
GND
-15.5VDC
SIG. REF.
VCC
VDD
-VDD
.1μF
10mV/g IN
CH 8
CH 1
1μF
(8) 1MEG
HI 508
U13
+VDD
-VDD
SINGLE CHANNEL
U9
U5
8.25K
215K
41.2 K
43.2 K
23.7 K
76.8 K
35.7 K
51.1K
32.4 K
118K
49.9 K
165K
25.5 K
154K
13.0 K
61.9 K
.047μF
.022μF
OPA 121 U8
10M
47
8P OUTPUT
WB OUTPUT
U5, U9 - TL074
*- 1% METAL FILM RN55
NOTE: ALL DIGITAL IC'S DECCUPLED
20479
DC
U-D CORP.
UD340
CIRCUIT SCHEMATIC
EIGHT CHANNEL MONITOR
C-20204
U #
VCC
GND
U10, U12
20
10
U2
14
7

FIG 8.9

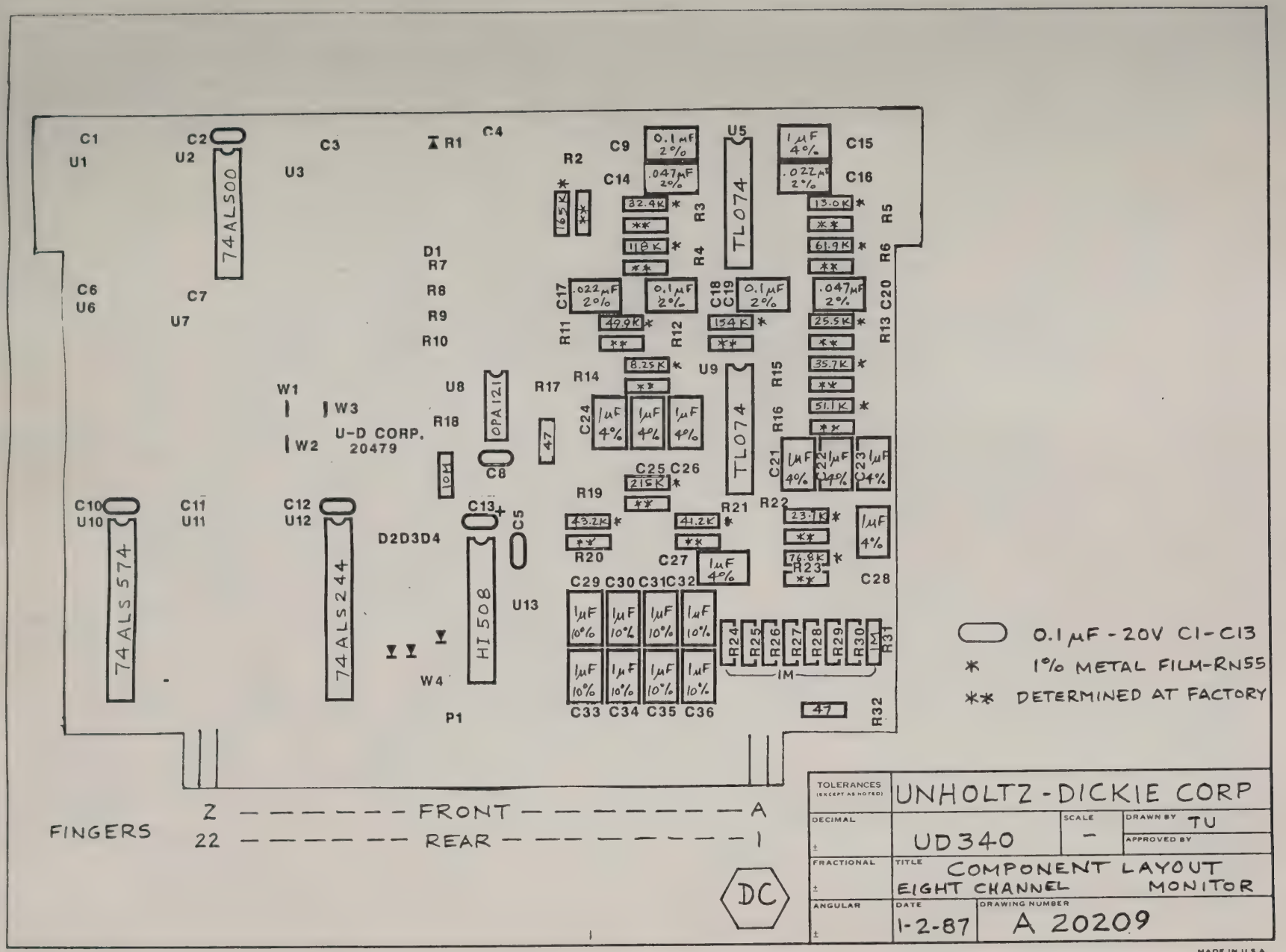

C1
U1
C2
U2
74ALS00
C3
U3
R1
C4
C9
0.1μF 2%
C14
.047μF 2%
R2
165K *
**
82.4K *
**
R3
U5
TL074
1μF 4%
C15
.022μF 2%
C16
13.0K *
**
R5
118K *
**
R4
61.9K *
**
R6
D1
R7
R8
R9
R10
C6
U6
C7
U7
C17
.022μF 2%
0.1μF 2%
C18
C19
0.1μF 2%
.047μF 2%
C20
R11
49.9K *
**
R12
154K *
**
25.5K *
**
R13
8.25K *
**
R14
U9
TL074
R15
35.7K *
**
51.1K *
**
R16
W1
W3
W2
U-D CORP.
20479
U8
OPA121
R17
R18
10M
C8
47
C24
1μF 4%
1μF 4%
1μF 4%
C21
1μF 4%
C22
1μF 4%
C23
1μF 4%
C25 C26
215K *
**
R19
R21
R22
43.2K *
**
R20
41.2K *
**
C27
1μF 4%
23.7K *
**
76.8K *
**
R23
1μF 4%
C28
C10
U10
74ALS574
C11
U11
C12
U12
74ALS244
D2D3D4
C13
C5
HI508
U13
C29 C30 C31 C32
1μF 10%
1μF 10%
1μF 10%
1μF 10%
R24
R25
R26
R27
R28
R29
R30
R31
1M
C33 C34 C35 C36
1μF 10%
1μF 10%
1μF 10%
1μF 10%
47
R32
W4
P1
FINGERS
Z — — — — — — FRONT — — — — — — A
22 — — — — — — REAR — — — — — — 1
DC
0.1μF - 20V C1-C13
* 1% METAL FILM-RN55
** DETERMINED AT FACTORY
TOLERANCES (EXCEPT AS NOTED)
DECIMAL ±
FRACTIONAL ±
ANGULAR ±
UNHOLTZ-DICKIE CORP
UD340
SCALE -
DRAWN BY TU
APPROVED BY
TITLE COMPONENT LAYOUT EIGHT CHANNEL MONITOR
DATE 1-2-87
DRAWING NUMBER A 20209
MADE IN U.S.A.

FIG 8.7

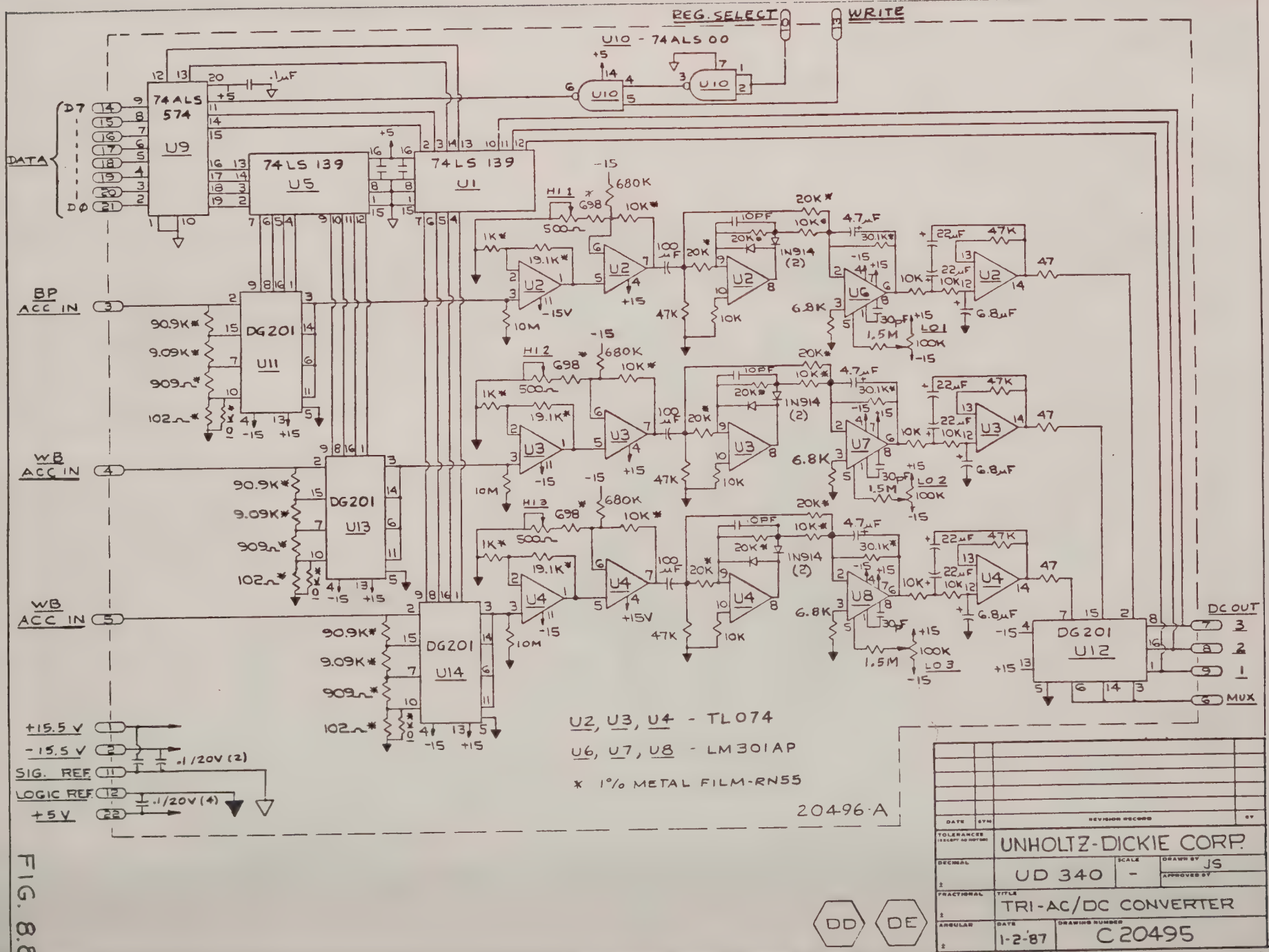
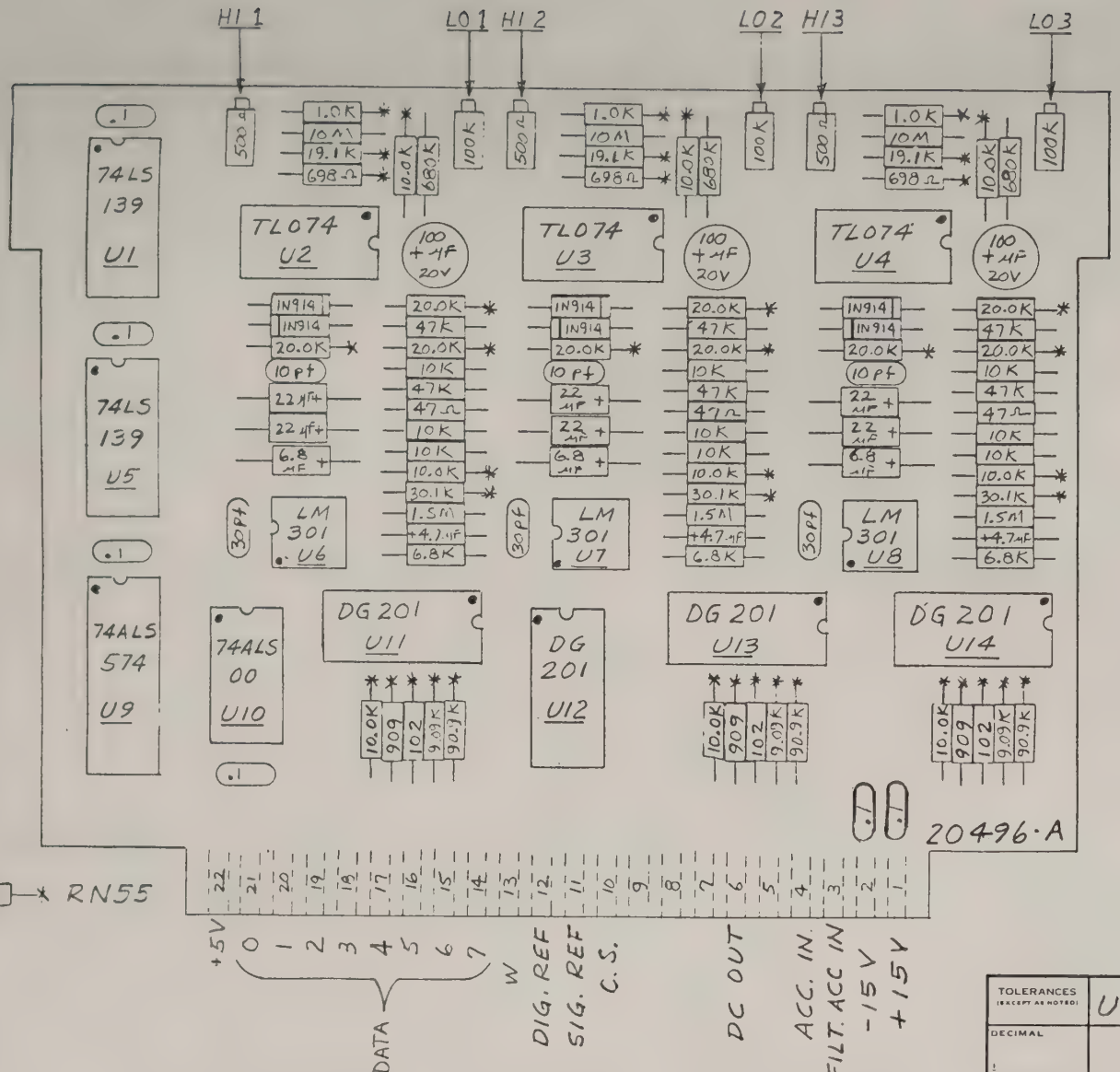

REG. SELECT
WRITE
U10 - 74ALS 00
DATA
D7
D0
74ALS 574 U9
74LS 139 U5
74LS 139 U1
BP ACC IN
WB ACC IN
WB ACC IN
DG201 U11
DG201 U13
DG201 U14
DG201 U12
90.9K*
9.09K*
909*
102*
680K
10K*
20K*
10M
47K
10pF
1N914 (2)
4.7µF
30.1K*
1.5M
100K
6.8µF
22µF
47K
47
LO1
LO2
LO3
DC OUT
MUX
+15.5 V
-15.5 V
SIG. REF
LOGIC REF
+5 V
.1/20V (2)
.1/20V (4)
U2, U3, U4 - TL074
U6, U7, U8 - LM301AP
* 1% METAL FILM-RN55
20496-A
UNHOLTZ-DICKIE CORP.
UD 340
TRI-AC/DC CONVERTER
C20495
1-2-87
DD
DE

FIG. 8.8



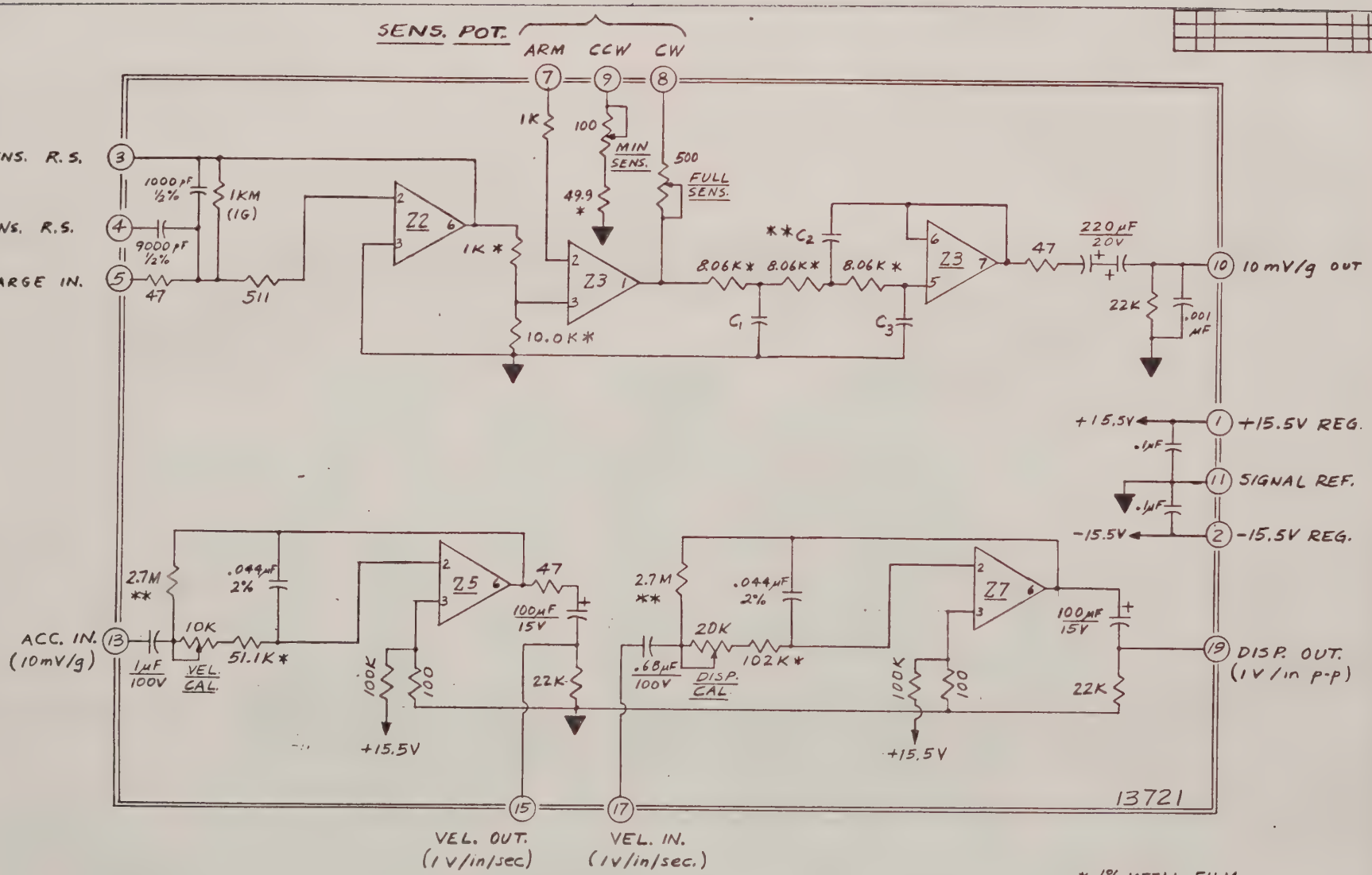
DD DE

FIG. 8.9

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±		SCALE	DRAWN BY LEM
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT TRI AC-DC CONVERTER		
ANGULAR	DATE 12-18-85	DRAWING NUMBER A 20474	

K·E ALBANENE W-10 8468 ENGINEERS STANDARD FORM

MADE IN U.S.A.



* 1% METAL FILM
** SHUNTED

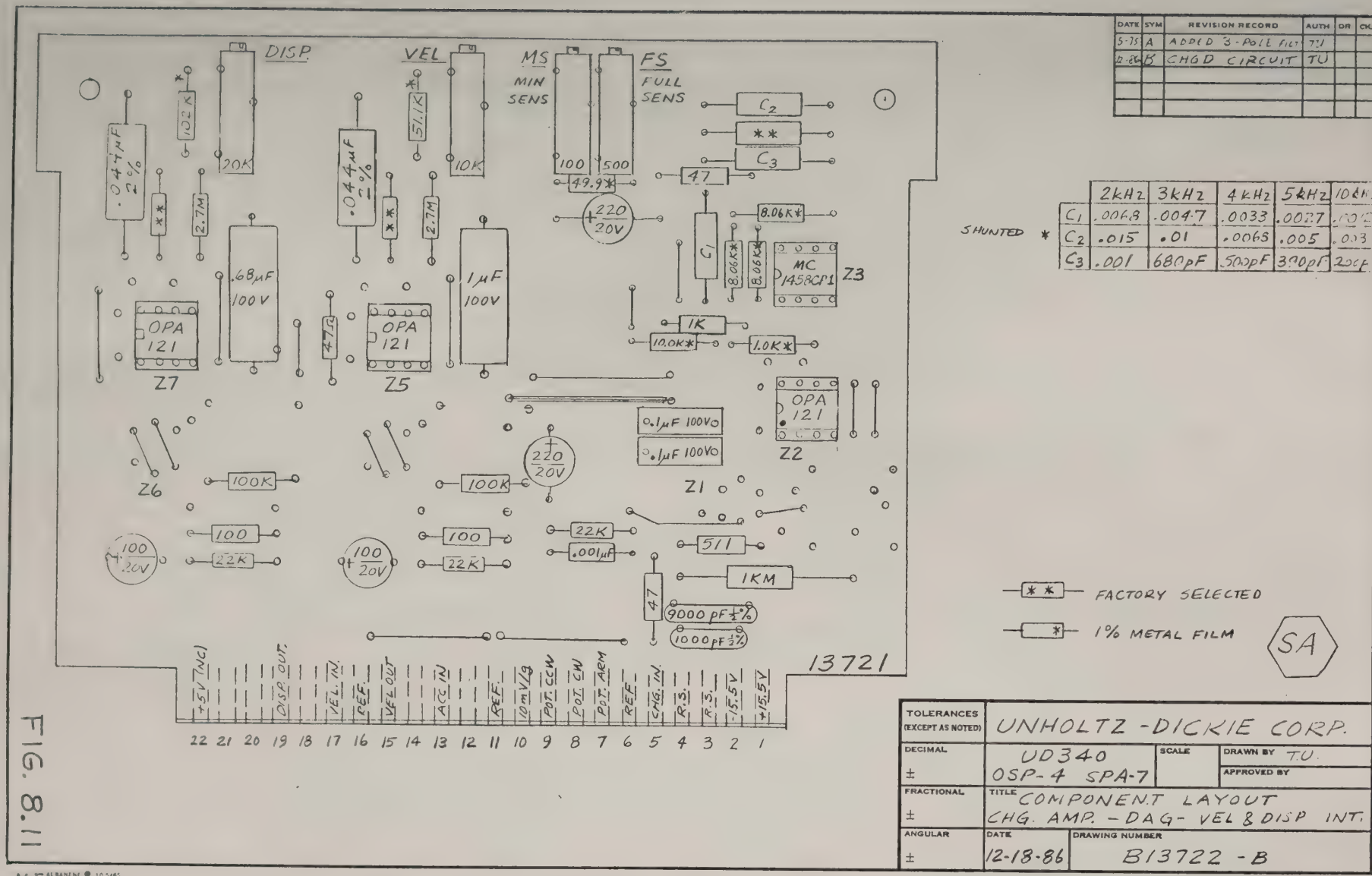
FIG. 8.10

	2kHz	3kHz	4kHz	5kHz	10kHz
C_1	.0068	.0047	.0033	.0027	.0012
C_2	.015	.01	.0068	.005	.003
C_3	.001	680pF	500pF	390pF	200pF

		PIN	
IC	TYPE	+16.5V	-16.5V
Z2,5,7	OPA 121	7	4
Z3	MC1458CP1	8	4
Z2,4,6	NOT USED		

SA

TOLERANCES EXCEPT AS NOTED	UNHOLTZ-DICKIE CORP.
DECIMAL ±	UD340 OSP-4 SPA-7
SCALE	–
DRAWN BY	TU
APPROVED BY	
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC CHG. AMP. - DAG - INT. CARD
ANGULAR ±	DATE 12-18-86
DRAWING NUMBER	C13737 - C



DATE	SYM	REVISION RECORD	AUTH	DR	CK.
5-15	A	ADDED 3-POLE FILT	TU		
12-86	B	CHGD CIRCUIT	TU		

SHUNTED *

	2kHz	3kHz	4kHz	5kHz	10kH
C1	.0068	.0047	.0033	.0027	.00
C2	.015	.01	.0068	.005	.003
C3	.001	680pF	500pF	390pF	200p

** FACTORY SELECTED

* 1% METAL FILM

SA

FIG. 8.11

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340 OSP-4 SPA-7	SCALE	DRAWN BY T.U.
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT CHG. AMP. - DAG - VEL & DISP INT.		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B13722-B	

K&E ALBANENE ● 10 5465 ENGINEERS' STANDARD FORM

MADE IN U.S.A.

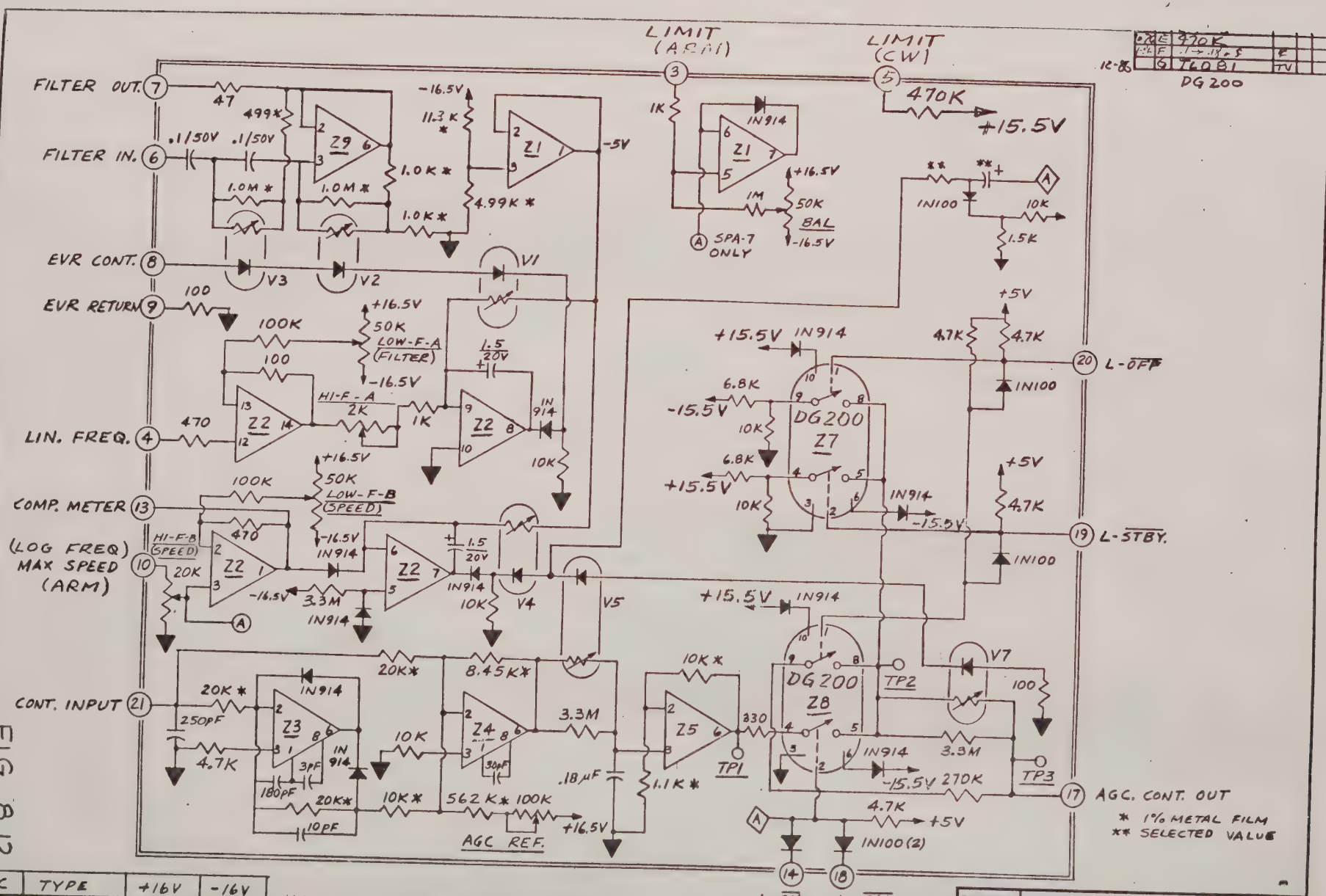


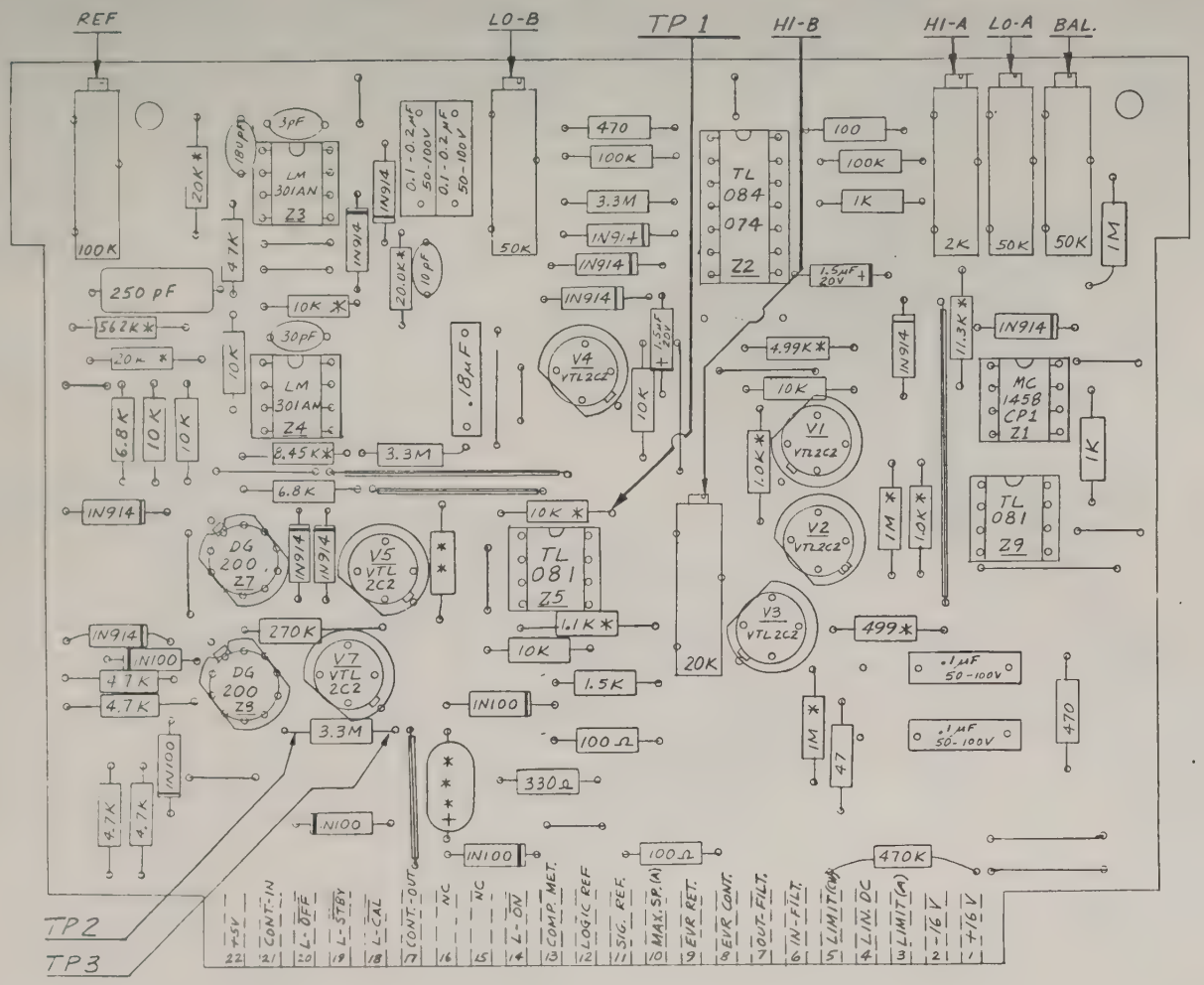
FIG. 8.12

IC	TYPE	+16V	-16V
Z1	MC1458CPI	8	4
Z2	TL074	4	11
Z3,Z4	LM301AN	7	4
Z5,Z9	TL081	7	4

V1, V2, V3 AND VTL2C2's ON SW-1 THRU 4 MATCHED (7)
V4, V5, V7 MATCHED VTL2C2's

SB

UNHOLTZ-DICKIE CORP.	
MOD SPA-7 MOD. OSP-4	SCALE –
TITLE	CIRCUIT SCHEMATIC AGC CONTROL CARD
DATE	5-23-75
DRAWING NUMBER	C13738 G



* 1% METAL FILM

** SELECTED (15K - 47K)

*** SELECTED (10 - 100 μF)

REVISION RECORD			
STA	A	PROTO. REV	TAL
	B		
ECN	C	CIR. CHGD	TAL

12-16	E	OP AMPS CHGD	TU

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ - DICKIE CORP.
DECIMAL ±	SPA-7 OSP-4 ID340
FRACTIONAL ±	TITLE COMPONENT LAYOUT AGC CONTROL CARD
ANGULAR ±	DRAWING NUMBER D13714-C

SB

FIG. 8.13

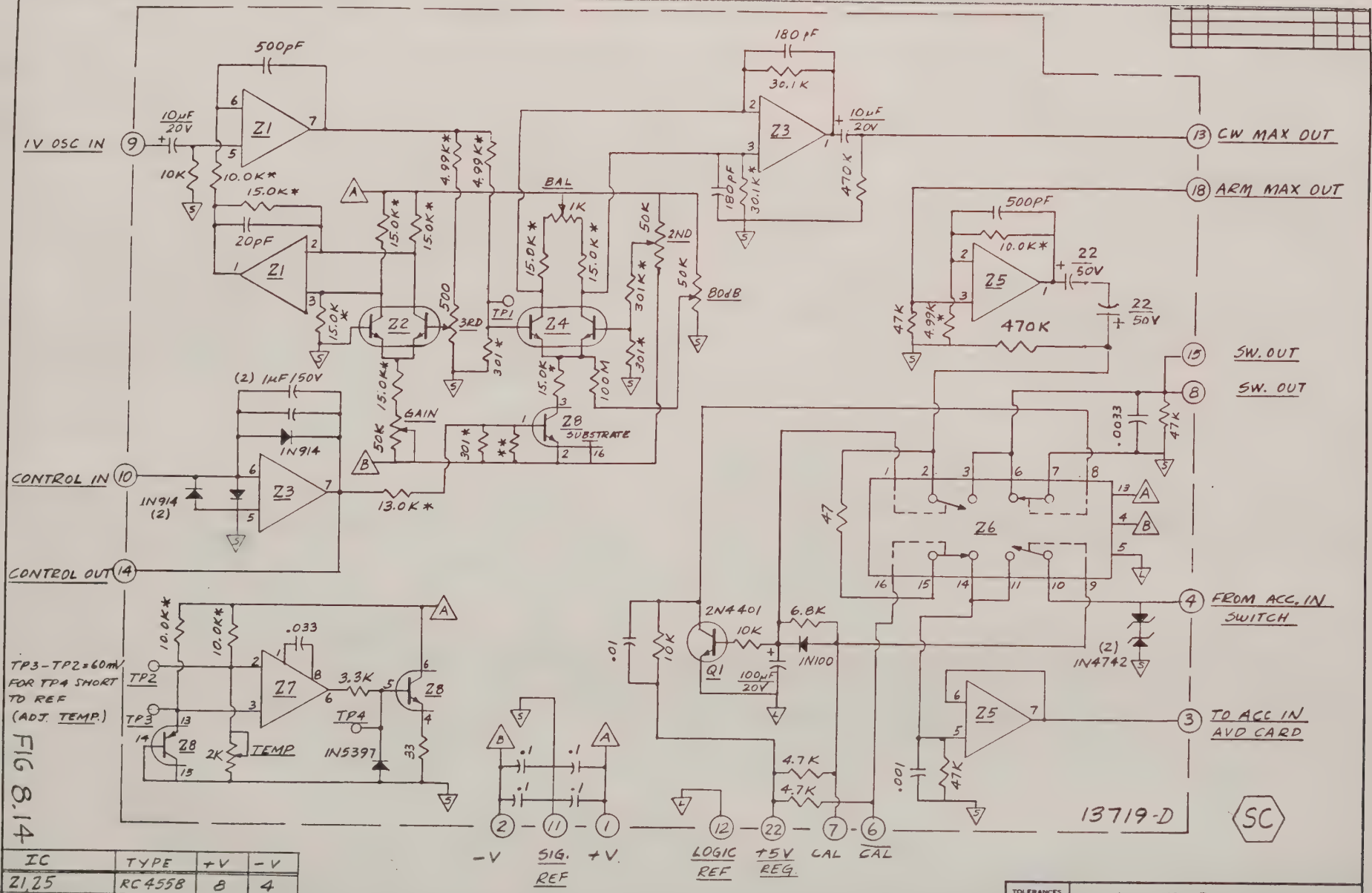


FIG 8.14

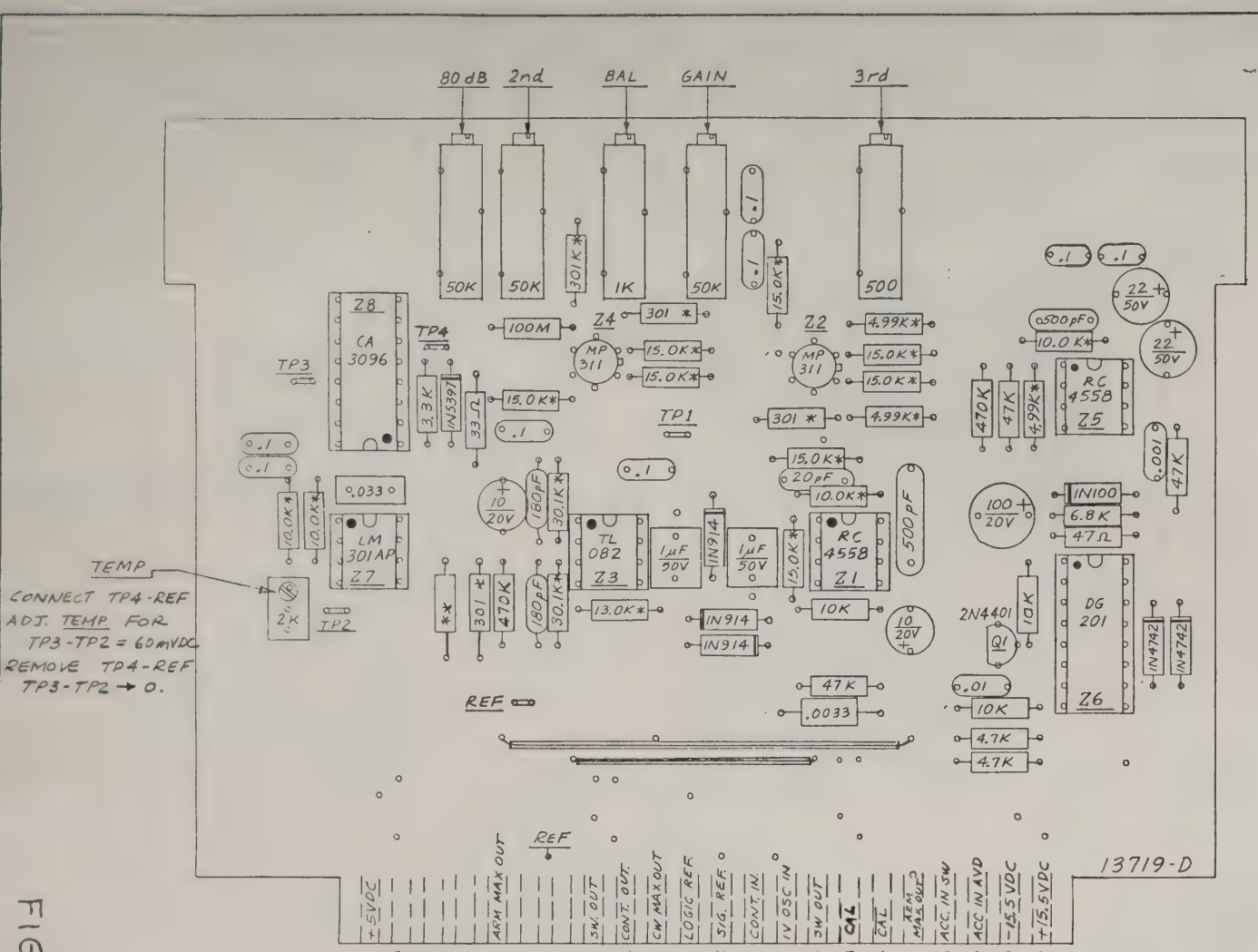
IC	TYPE	+V	-V
Z1,25	RC4558	8	4
Z2,24	MP311	-	-
Z3	TL082	8	4
Z6	DG201	13	4
Z7	LM301	7	4
Z8	CA3096	-	-

* 1% METAL FILM RN55

** FACTORY SELECTED

V- 15 TO 16.5 VDC

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP
DECIMAL	UD 340 OSP-4 SPA-7
SCALE	—
DRAWN BY	TU
APPROVED BY	
FRACTIONAL	TITLE: CIRCUIT SCHEMATIC AGC AMPL. CARD
ANGULAR	DATE: 12-17-86
DRAWING NUMBER	C20201



* 1% METAL FILM
** DETERMINED AT CHECKOUT

FIG 8.15

SC

UNHOLTZ-DICKIE CORP.	
UD340	
COMPONENT LAYOUT AGC AMPLIFIER	
10-2-86	B 13720 D

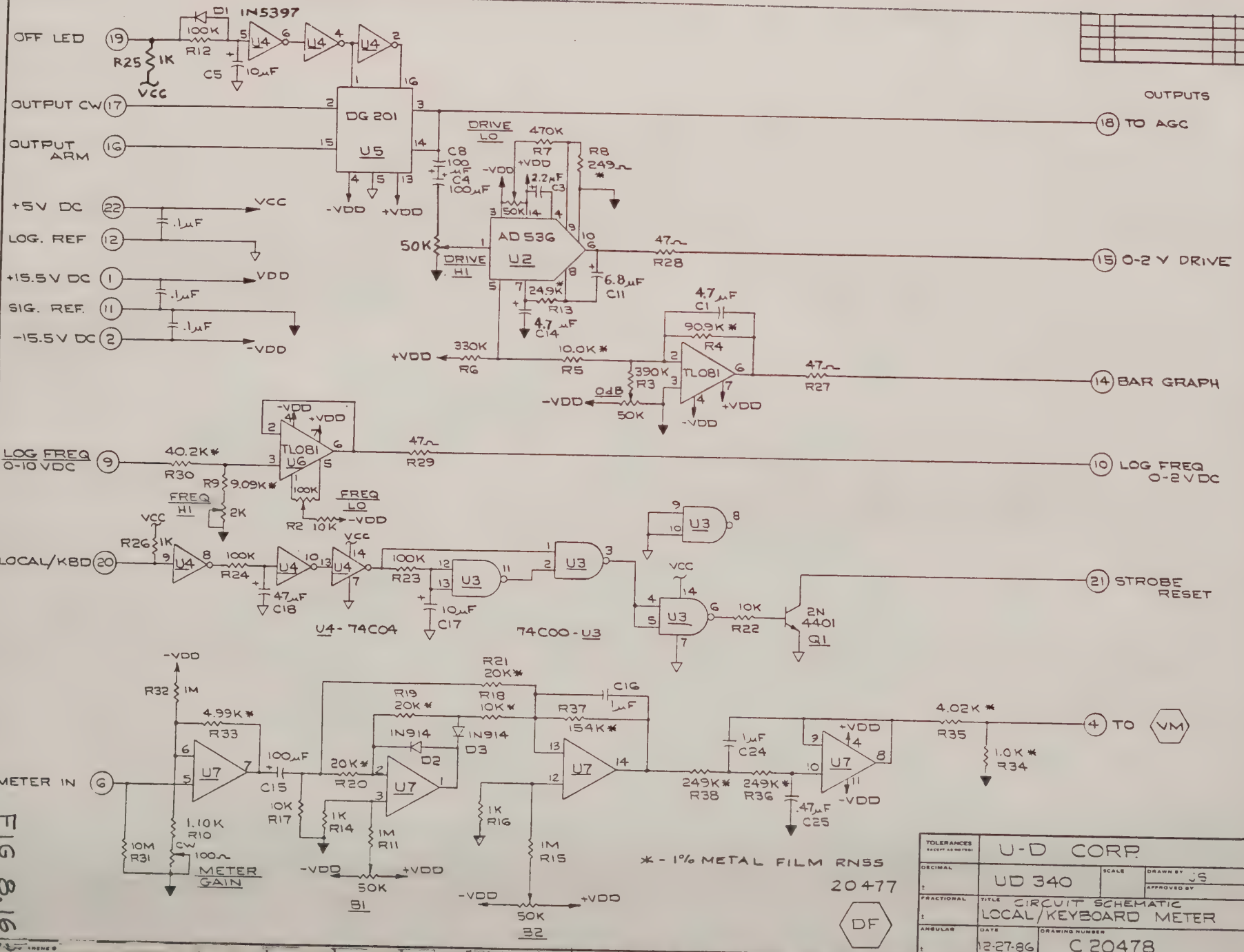
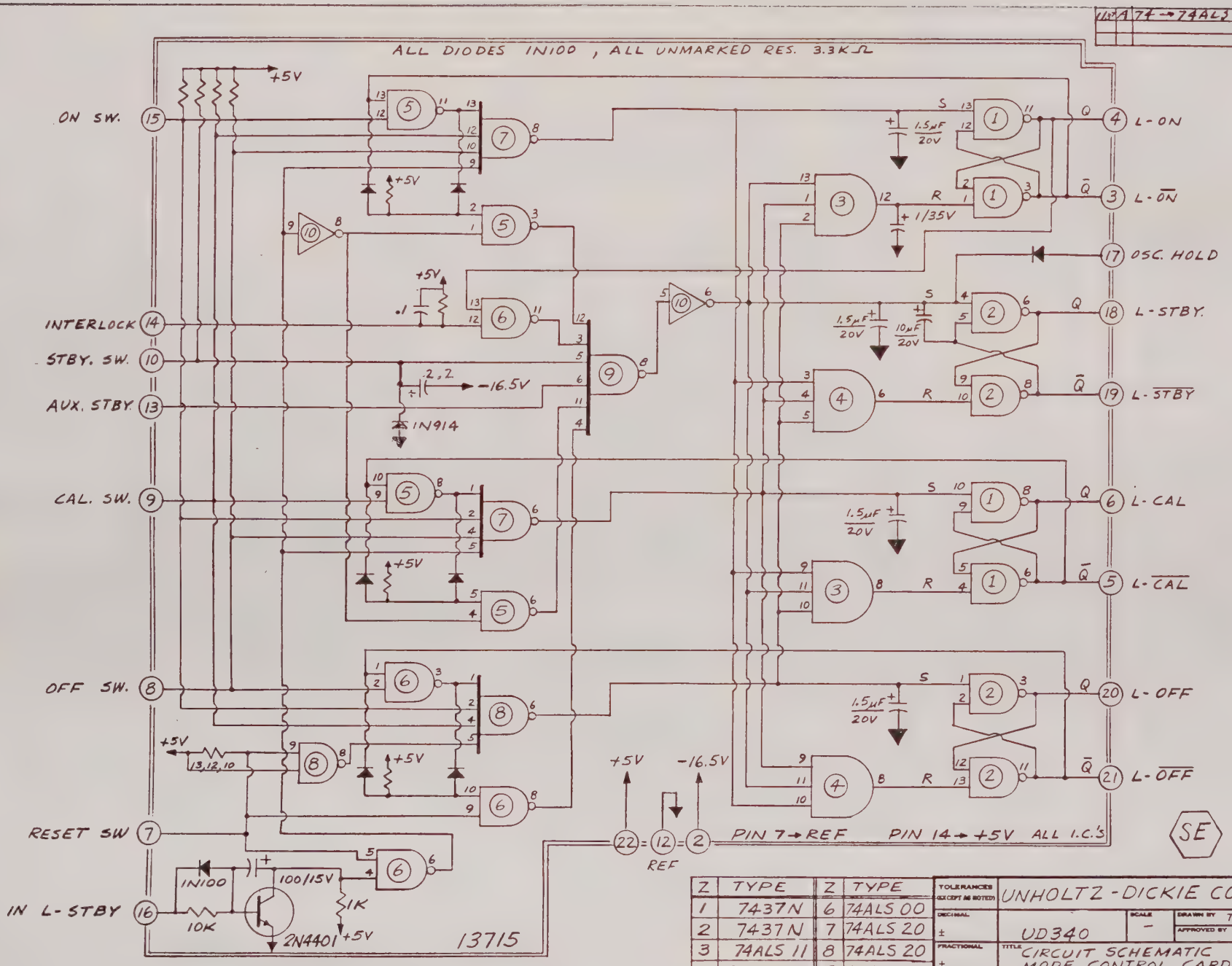

OFF LED
19
D1 IN5397
100K
R12
R25 1K
VCC
C5 10µF
U4
OUTPUT CW
17
OUTPUT ARM
16
DG 201
U5
OUTPUTS
18 TO AGC
DRIVE LO
470K
R7
R8 249Ω
C8 100µF
C4 100µF
-VDD
+VDD
2.2µF C3
50K
AD 536
U2
50K
DRIVE HI
47Ω
R28
15 0-2 V DRIVE
6.8µF C11
24.9K
R13
4.7µF C14
+5V DC
22
.1µF
LOG. REF
12
+15.5V DC
1
SIG. REF.
11
-15.5V DC
2
4.7µF C1
909K
R4
330K
R6
10.0K
R5
390K
R3
TL081
0dB
50K
47Ω
R27
14 BAR GRAPH
LOG FREQ 0-10 VDC
9
40.2K
R30
R9 9.09K
TL081 U6
47Ω
R29
10 LOG FREQ 0-2 V DC
FREQ HI
2K
100K
FREQ LO
R2 10K
LOCAL/KBD
20
R26 1K
100K
R24
47µF C18
100K
R23
10µF C17
U4 - 74C04
74C00 - U3
U3
10K
R22
2N 4401 Q1
21 STROBE RESET
R32 1M
4.99K
R33
R21 20K
R19 20K
R18 10K
C16 1µF
R37 154K
IN914 D2
IN914 D3
100µF C15
20K R20
10K R17
1K R14
1M R11
1K R16
1M R15
10M R31
1.10K R10 CW
100Ω
METER GAIN
METER IN
6
50K
B1
50K
B2
1µF C24
249K R38
249K R36
.47µF C25
4.02K
R35
1.0K R34
4 TO VM
* - 1% METAL FILM RN55
20477
DF
TOLERANCES
U-D CORP
UD 340
SCALE
DRAWN BY JS
APPROVED BY
TITLE CIRCUIT SCHEMATIC
LOCAL/KEYBOARD METER
DATE 12-27-86
DRAWING NUMBER C 20478

FIG 8.16

DRIVE HI
0dB
DRIVE LO
FREQ LO
FREQ HI
METER GAIN
METER B1
B2
U-D CORP.
20477
DRIVE HI
ODB
DRIVE LO
FREQ LO
FREQ HI
METER GAIN
B1
B2
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C21
C22
C23
C24
C25
D1
D2
D3
1N5192
1N914
1N914
U1
U2
U3
U4
U5
U6
U7
TL081
AD536
74C00
74C04
DG201
TL081
TL074
Q1
2N4401
E
B
C
+5V DC
STROBE RST.
LOCAL / KBD
OFF LED
TO AGC
OUTPUT CW
OUTPUT ARM
0-2V DRIVE
BAR GRAPH
REF
0-2V LOG FREQ
0-10V LOG FREQ
METER IN
TO VM
-15.5 VDC
+15.5 VDC
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
DF
* - 1% METAL FILM RN55
CAP. 0.1μF/20V
UNHOLTZ-DICKIE CORP.
TOLERANCES (EXCEPT AS NOTED)
DECIMAL ±
FRACTIONAL ±
ANGULAR ±
UD340
SCALE
DRAWN BY TU
APPROVED BY
TITLE COMPONENT LAYOUT LOCAL/KEYBOARD-METER CARD
DATE 12-29-86
DRAWING NUMBER A202206
MADE IN U.S.A.

FIG. 8.17



Z	TYPE	Z	TYPE
1	7437N	6	74ALS00
2	7437N	7	74ALS20
3	74ALS11	8	74ALS20
4	74ALS11	9	74ALS30
5	74ALS00	10	74ALS04

TOLERANCES (EXCEPT AS NOTED): DECIMAL ±, FRACTIONAL ±, ANGULAR ±

UNHOLTZ-DICKIE CORP.

UD340

SCALE –

DRAWN BY TU

APPROVED BY

TITLE: CIRCUIT SCHEMATIC MODE CONTROL CARD

DATE: 12-20-86

DRAWING NUMBER: C13740-A

FIG. 8.18

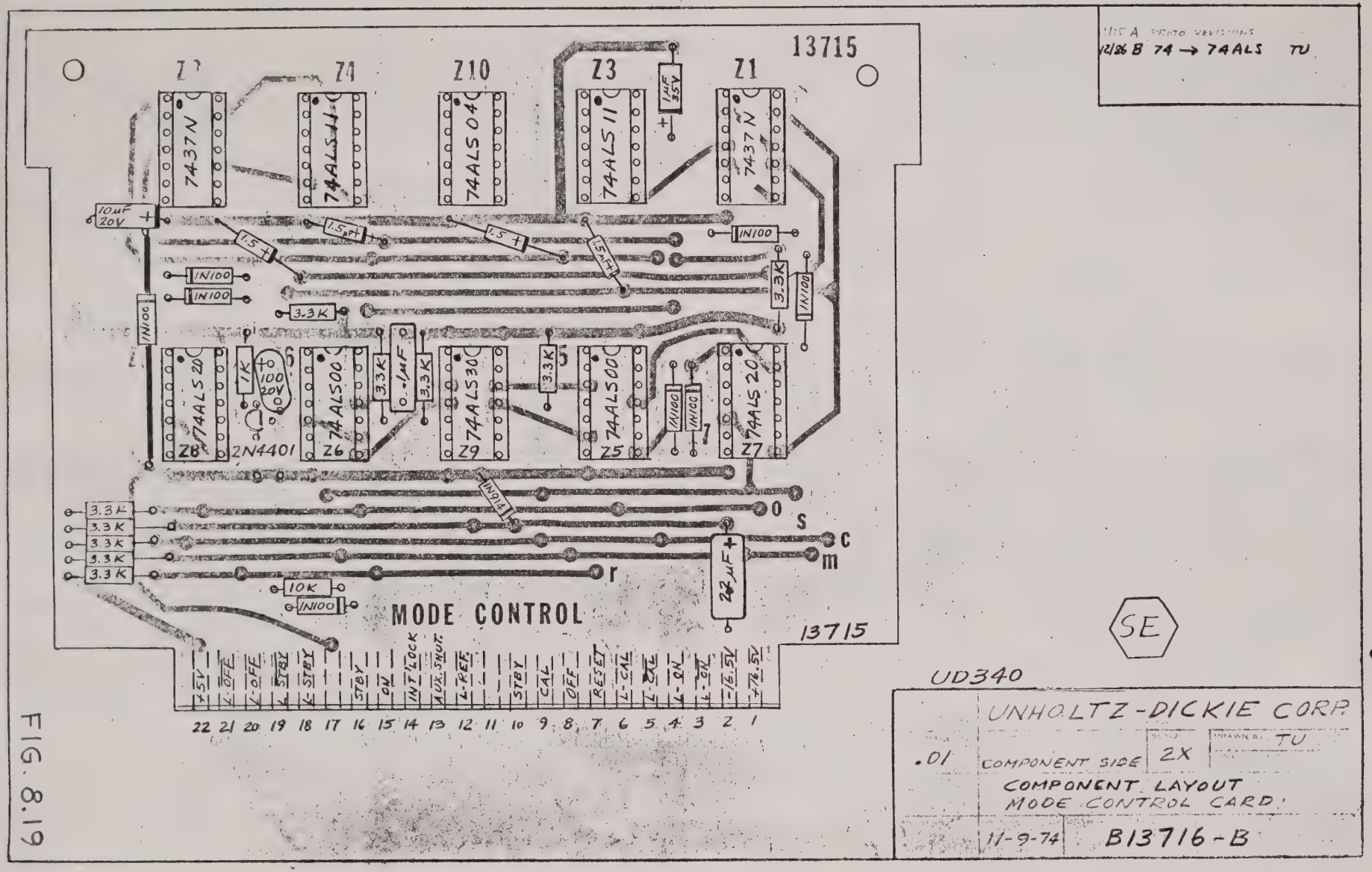


FIG. 8.19

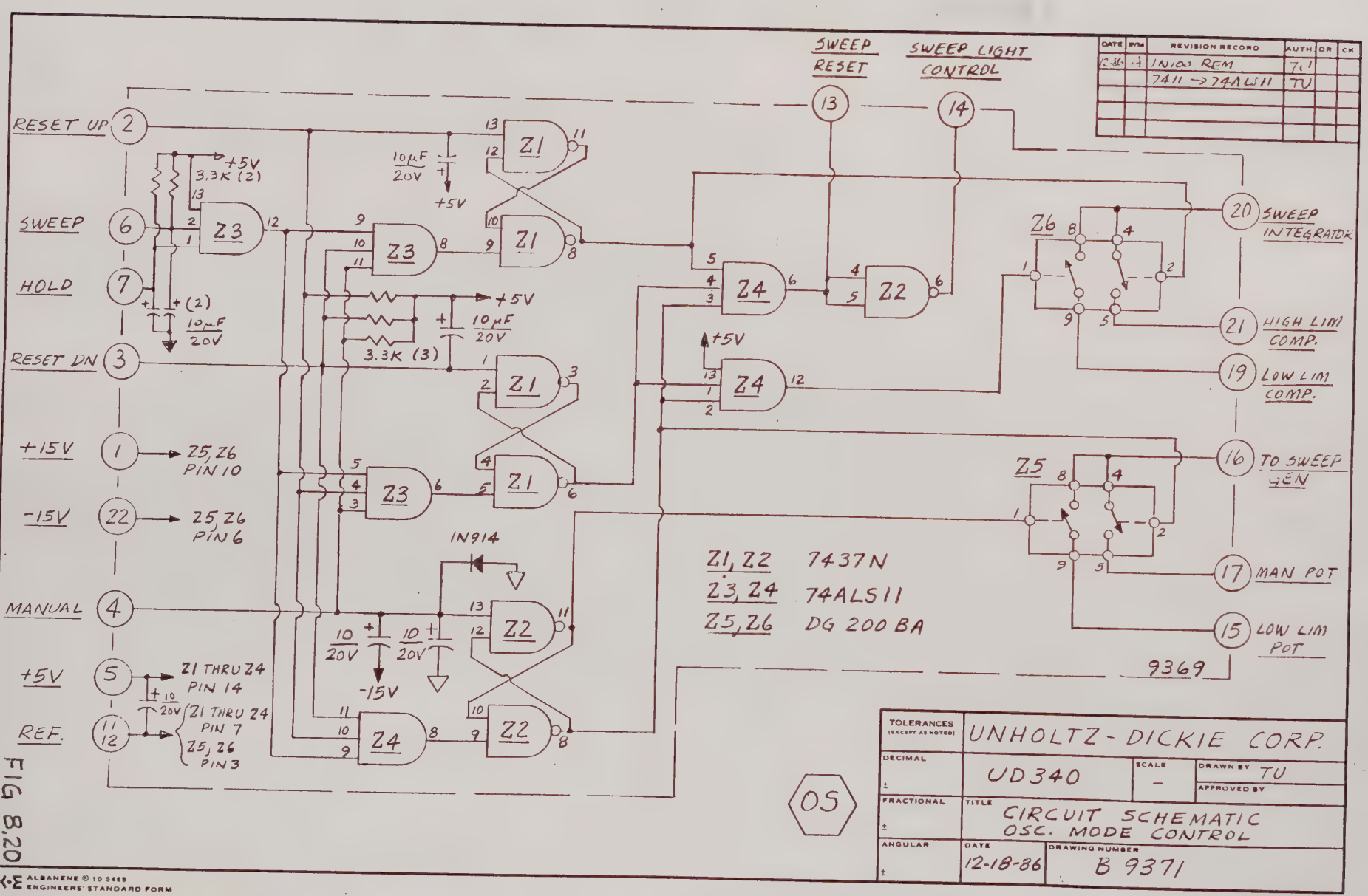
UNIT A PROTO REVISIONS
12/26 B 74 → 74ALS TU

SE

UD340

UNHOLTZ-DICKIE CORP.

.01	COMPONENT SIDE	2X	DRAWN BY TU
	COMPONENT LAYOUT MODE CONTROL CARD		
	11-9-74	B13716-B	



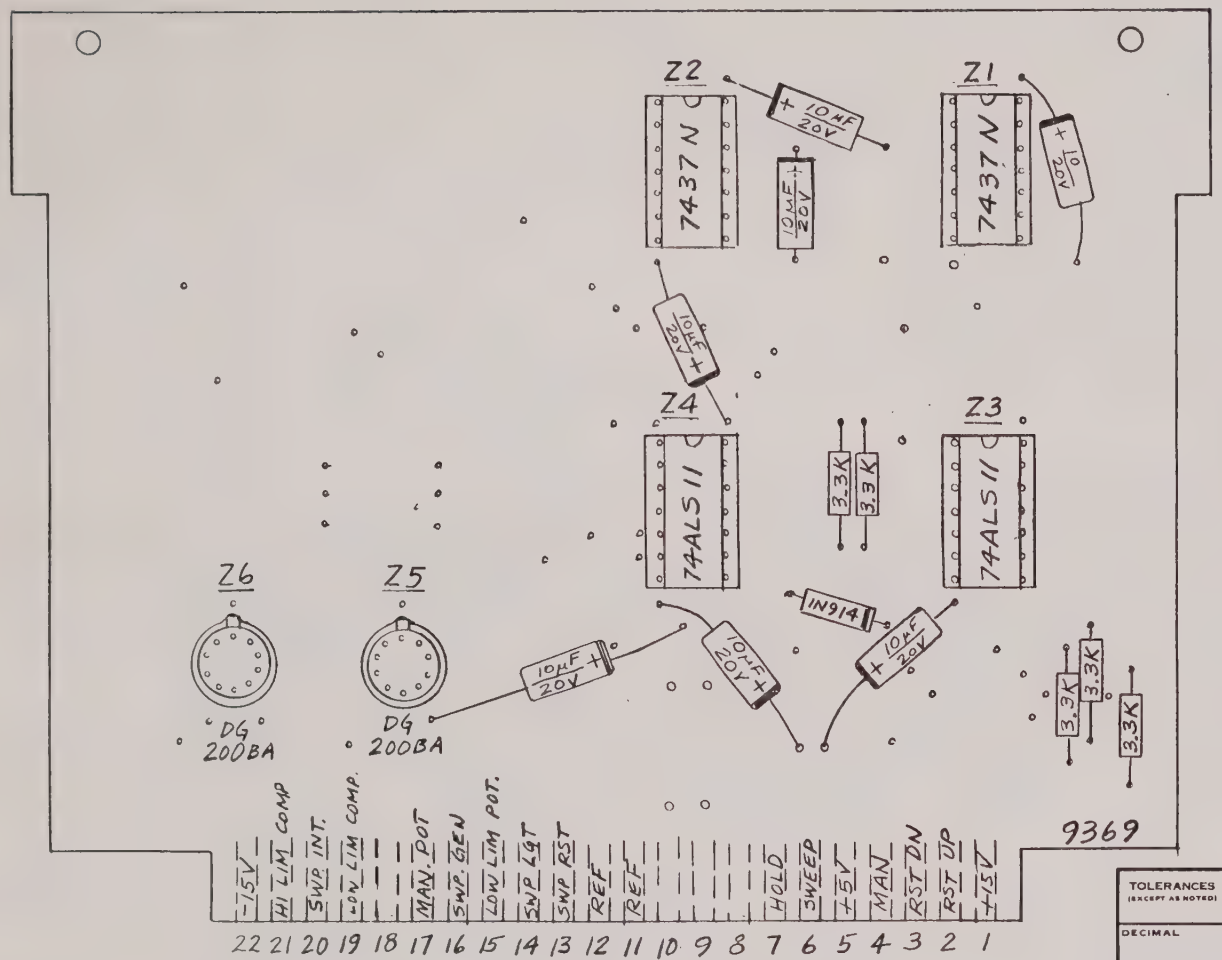
DATE	SYM	REVISION RECORD	AUTH	DR	CK
12-86	1	IN100 REM	TU		
		7411 → 74ALS11	TU		

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340	SCALE –	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC OSC. MODE CONTROL		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B 9371	

FIG 8.20

K·E ALBANENE © 10 5465 ENGINEERS' STANDARD FORM

MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH	DR	CK
12-86	A	IN100 REMVD	TU		
		7411 → 74ALS11	TU		

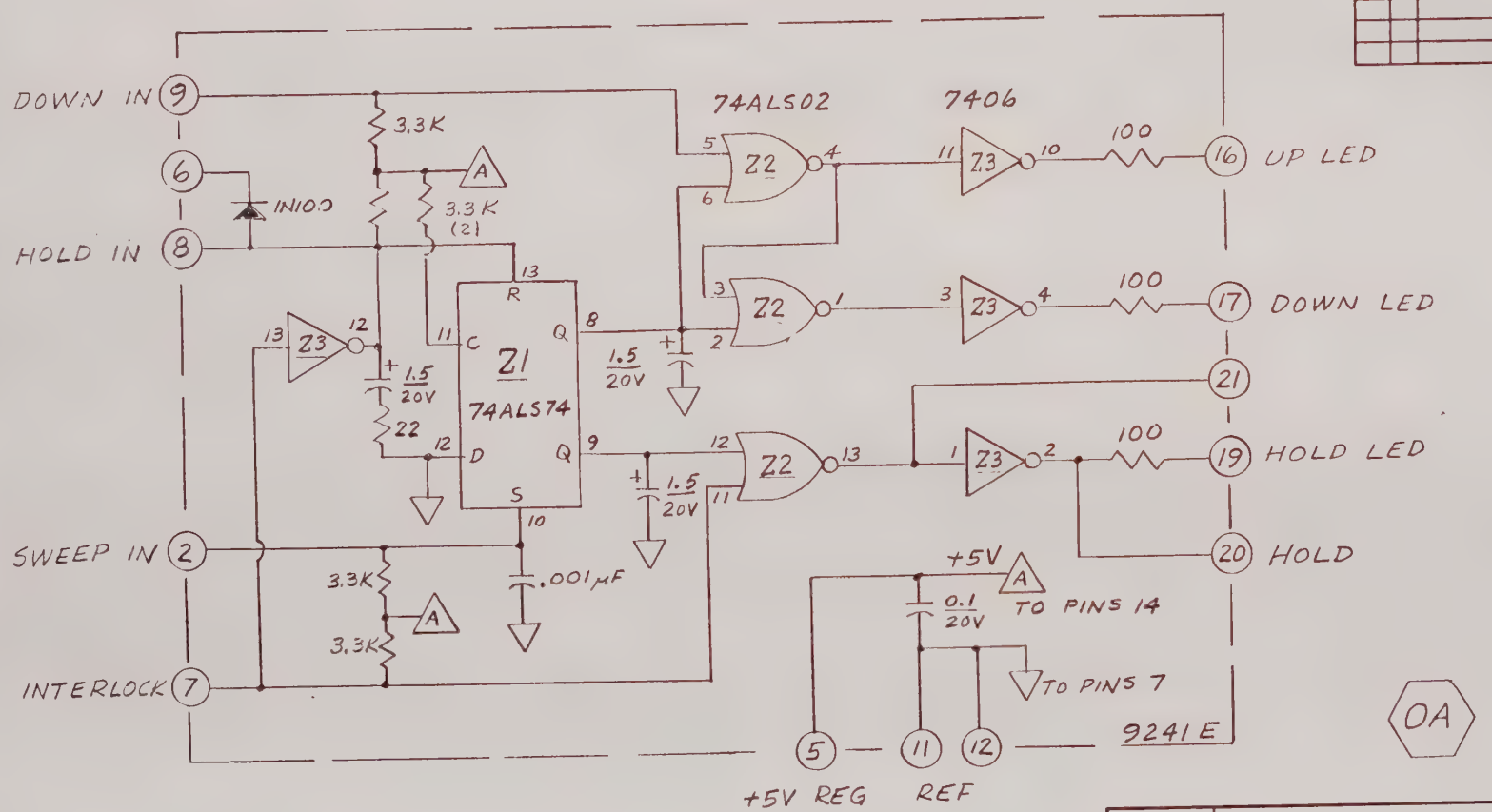
OS

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD340	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE OSCILLATOR MODE CONTROL COMPONENT LAYOUT		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B9370 A	

FIG. 8.21

K·E ALBANENE © 10 8466 ENGINEERS' STANDARD FORM

MADE IN U.S.A.



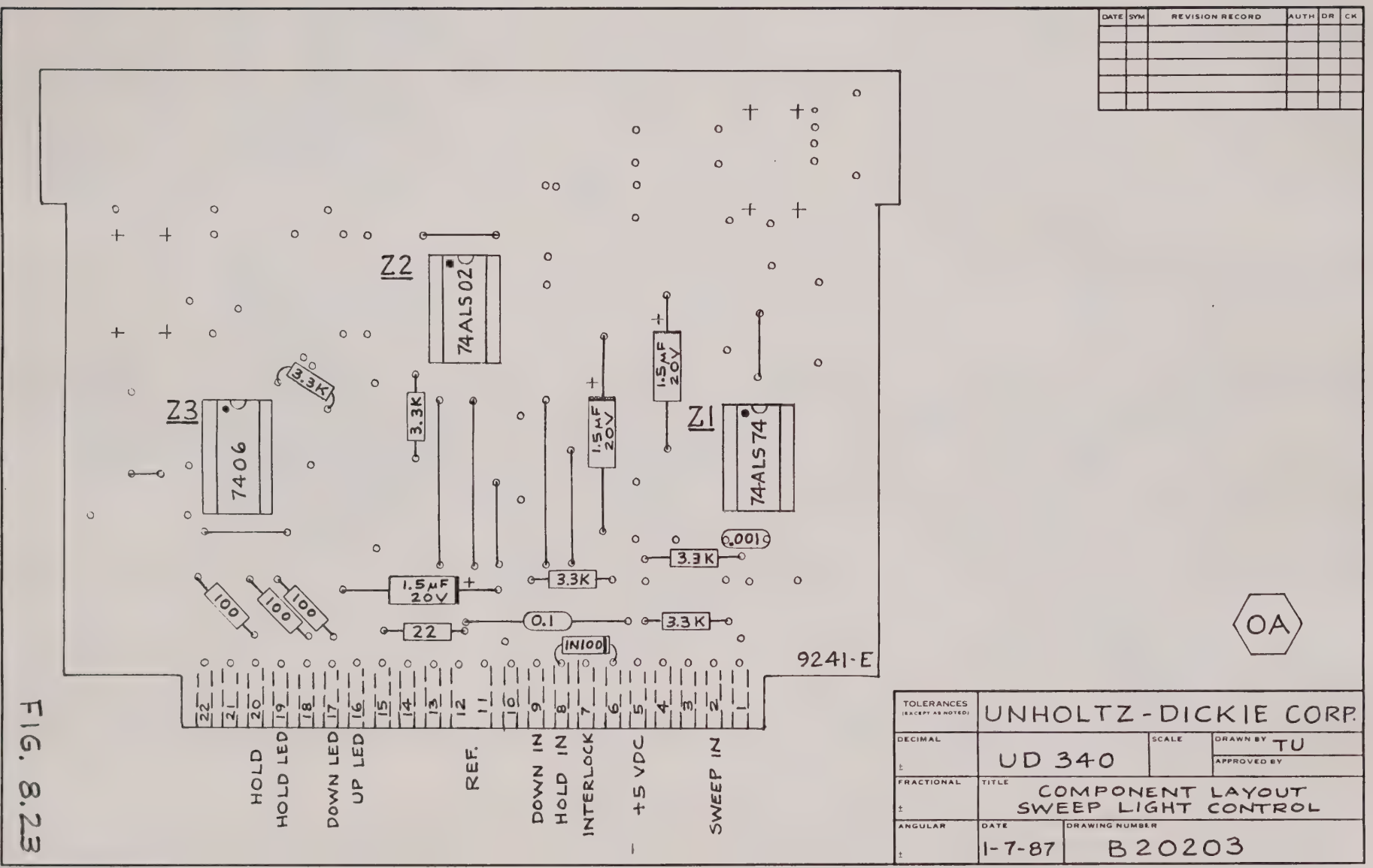
DATE	SYM	REVISION RECORD	AUTH	DR	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD 340	SCALE	DRAWN BY LCI
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC SWEEP LIGHT CONTROL		APPROVED BY
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER B20202	

MADE IN U.S.A.

FIG. 8.22

K·E ALBANENE 10 5465 ENGINEERS' STANDARD FORM



DATE	SYM	REVISION RECORD	AUTH	DR	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD 340	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT SWEEP LIGHT CONTROL		
ANGULAR ±	DATE 1-7-87	DRAWING NUMBER B 20203	

FIG. 8.23

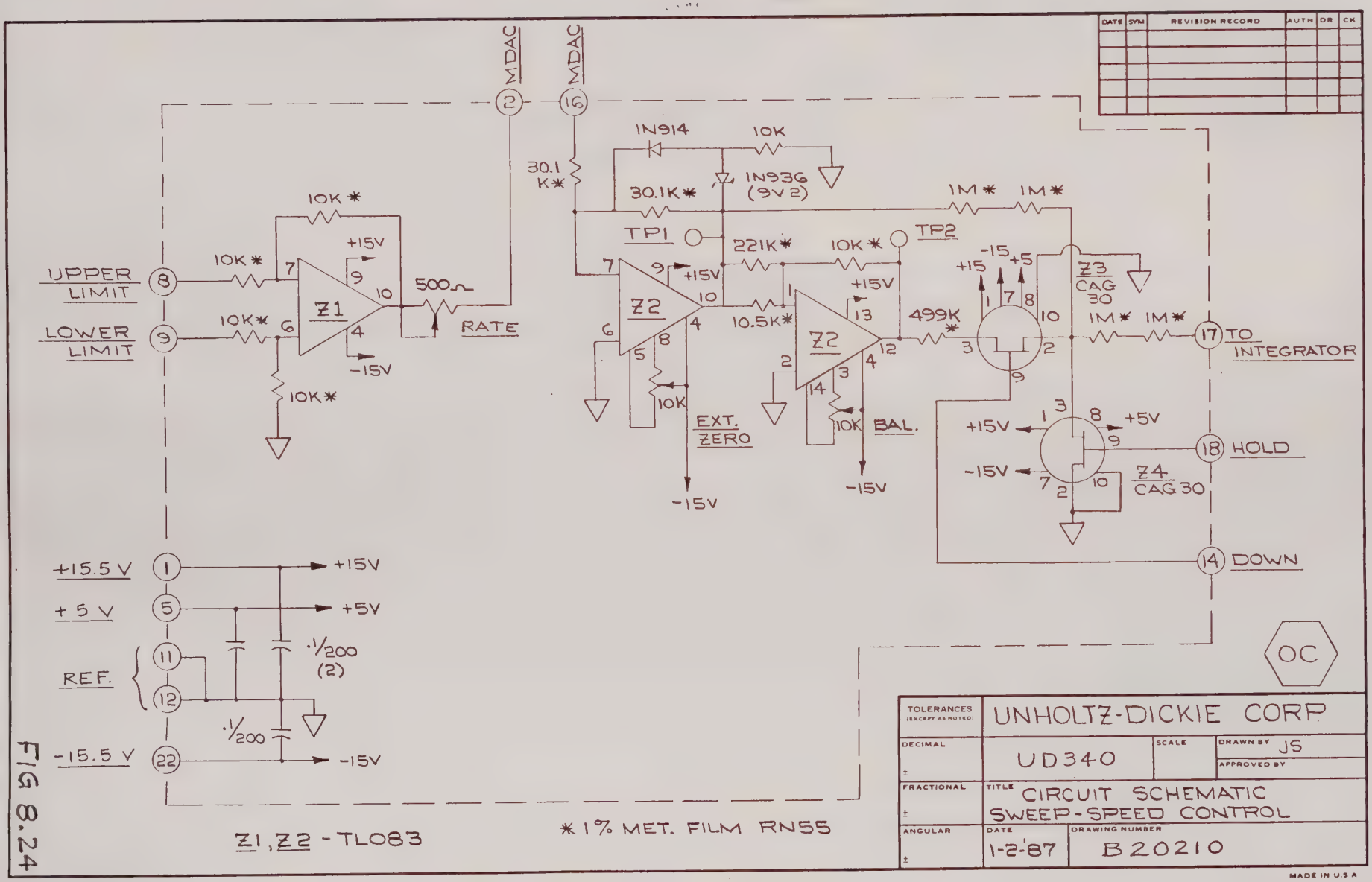
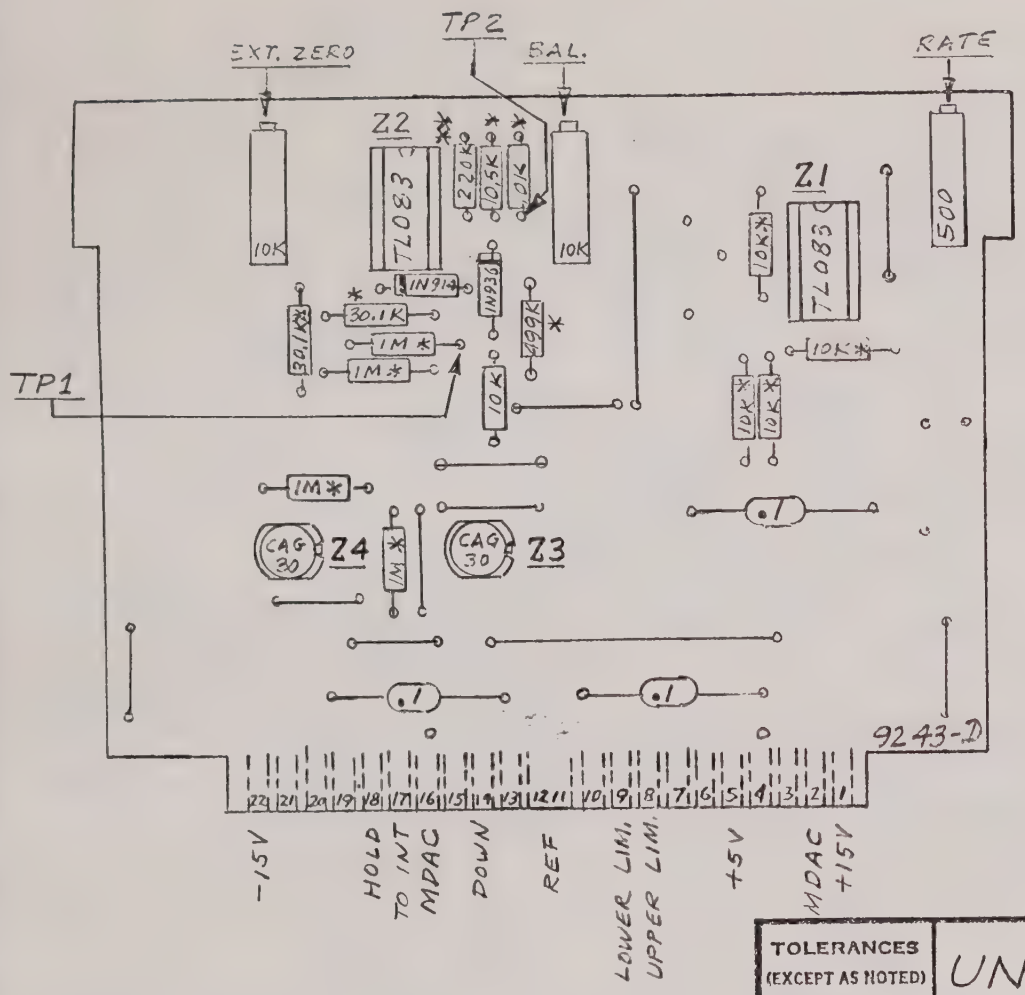

MDAC
MDAC
2
16
IN914
10K
30.1 K*
IN936 (9V2)
30.1K*
1M*
1M*
TP1
TP2
221K*
10K*
+15V
-15V
+15
+5
Z3 CAG 30
UPPER LIMIT
LOWER LIMIT
8
9
10K*
Z1
500Ω
RATE
Z2
10.5K*
499K*
17
TO INTEGRATOR
EXT. ZERO
10K
BAL.
18
HOLD
Z4 CAG 30
14
DOWN
+15.5 V
+5 V
REF.
11
12
22
.1/200 (2)
.1/200
-15.5 V
Z1, Z2 - TL083
*1% MET. FILM RN55
OC
UNHOLTZ-DICKIE CORP
UD340
CIRCUIT SCHEMATIC
SWEEP-SPEED CONTROL
B20210
1-2-87
JS
MADE IN U.S.A.

FIG 8.24

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
5-75	A	BOARD DIM. CHGD	TU		
		15K 1% (16 TO 4)	TU		
9-75	B	499K* POS. CHGD	TU		
12-86	C	MA747→TL073			
		CKT CHGS	TU		



OC

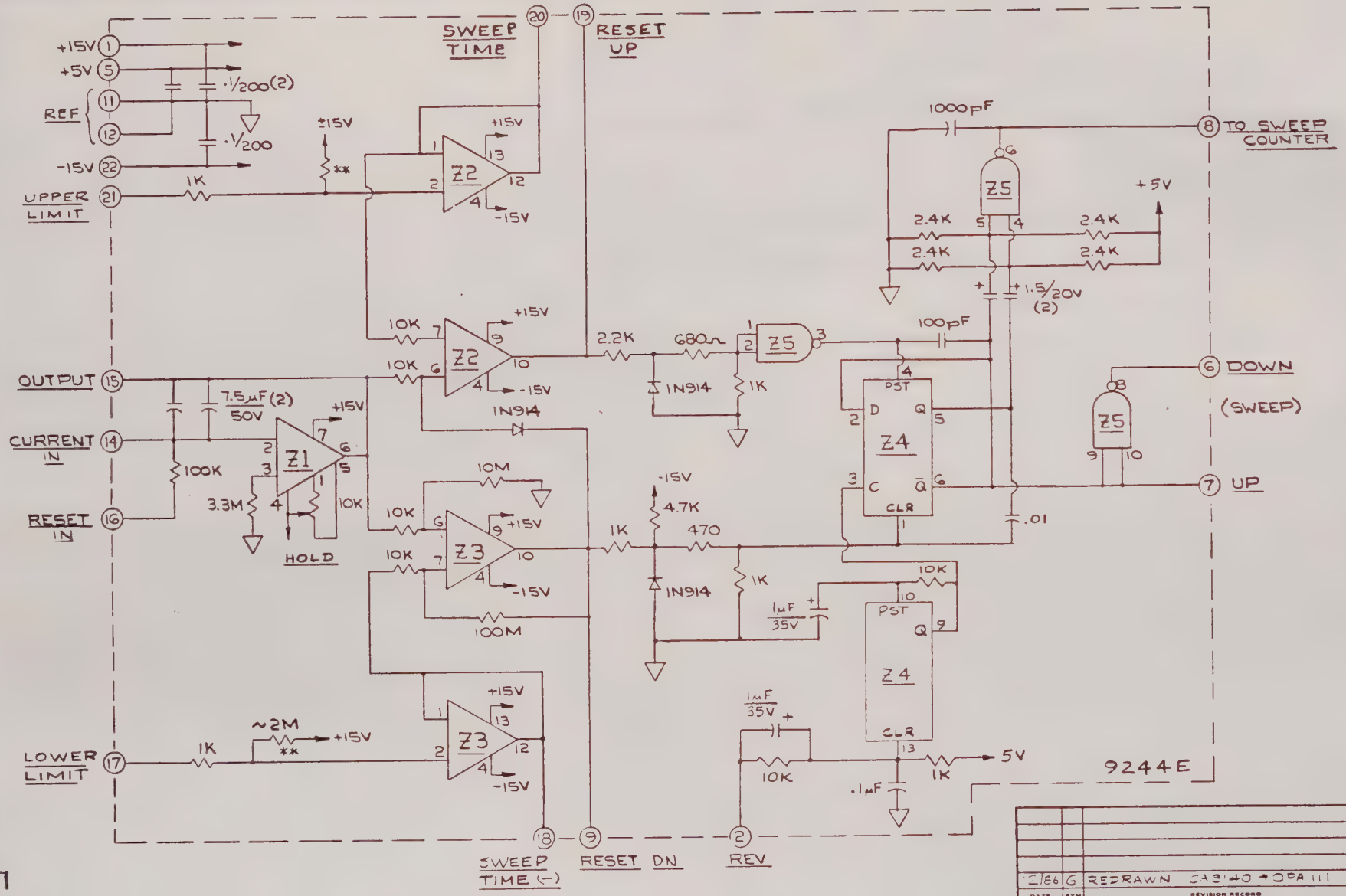
** ADJUSTED AT FACTORY

* 1% METAL FILM.

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT SWEEP SPEED CONTROL		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER A9298 C	

FIG. 8.25

MADE IN U.S.A.



Z1 - OPA 111
Z2, Z3 - TL083
Z4 - 74C74
Z5 - 74ALS00

** - FACTORY SELECTED

Z4, Z5 HAVE +5V ON PIN 14, GND ON PIN 7

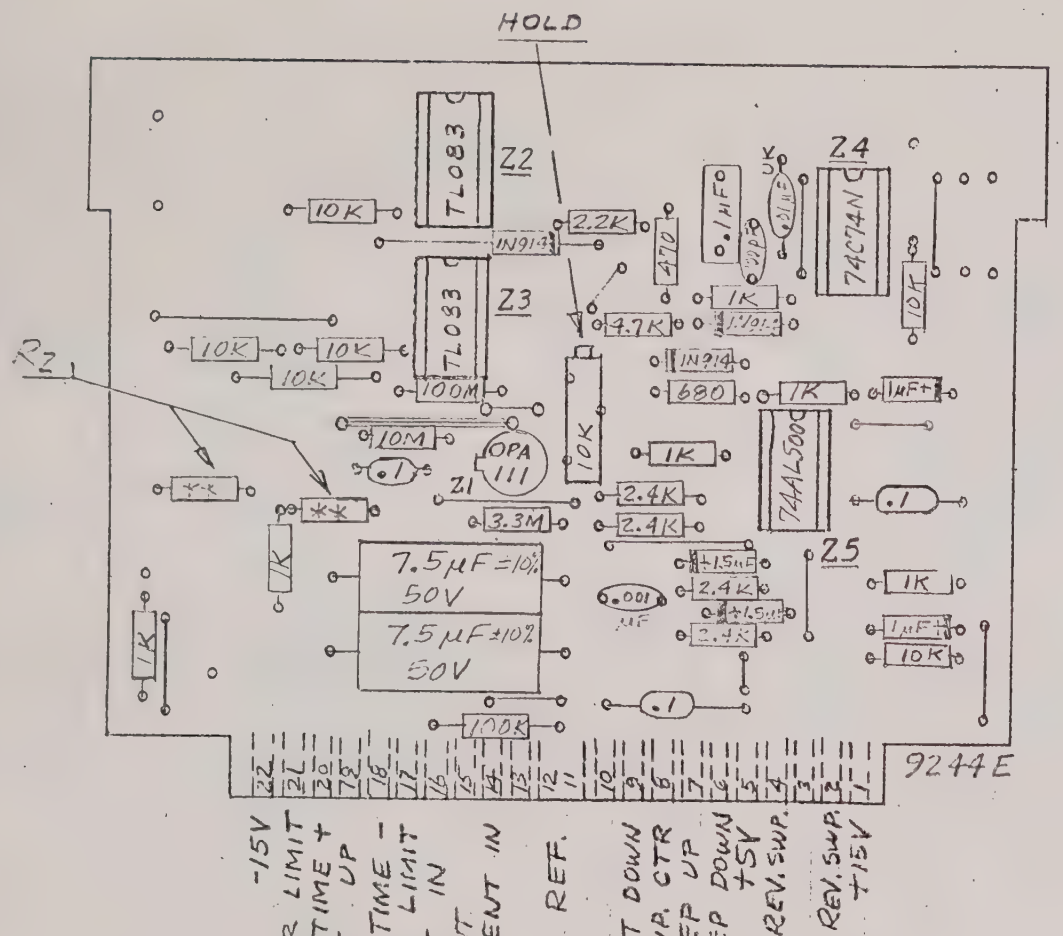
2/86	G	REDRAWN CA3140 → OPA 111	TU
DATE	BY	REVISION RECORD	BY

UNHOLTZ-DICKIE CORP.

DECIMAL ±	UD 340 OSP-4	SCALE	DRAWN BY JS
FRACTIONAL ±	TITLE SWEEP GENERATOR BOARD D-OSC		APPROVED BY
ANGULAR ±	DATE 1-3-87	DRAWING NUMBER C9296 - G	

OD

FIG. 8.26



DATE	SYM	REVISION RECORD	AUTH	DR.	CK.
5-75	B	AD590J + 10M	TU		
6-75	C	4.7K ADDED 1.5/20	TC		
1-76	D	2.4K ADDED	TU		
5-77	E	CKT. CHG Z4	TU		
6-80	F	CHG AD540J TO CA3140	JF		
11-82	G	CHG REV CKT	JF		
9-84	H	74C74N WAS 7474N, CAP NOTES			
12-86	J	7400→74ALS00			
		CA3140 → OPA 111			

OD

NOTE: "UK" = .01µF/25V, ±20% DISK CERAMIC, CENTRALAB NO. UK-25-103
7.5µF: 7.5µF/50V, ±10% METALIZED POLYCARB, WESCO TYPE 32MPC

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340	SCALE 1	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT D-OSC SWEEP GENERATOR		
ANGULAR ±1	DATE 5-10-79	DRAWING NUMBER A 9299 - J	

FIG. 8.27

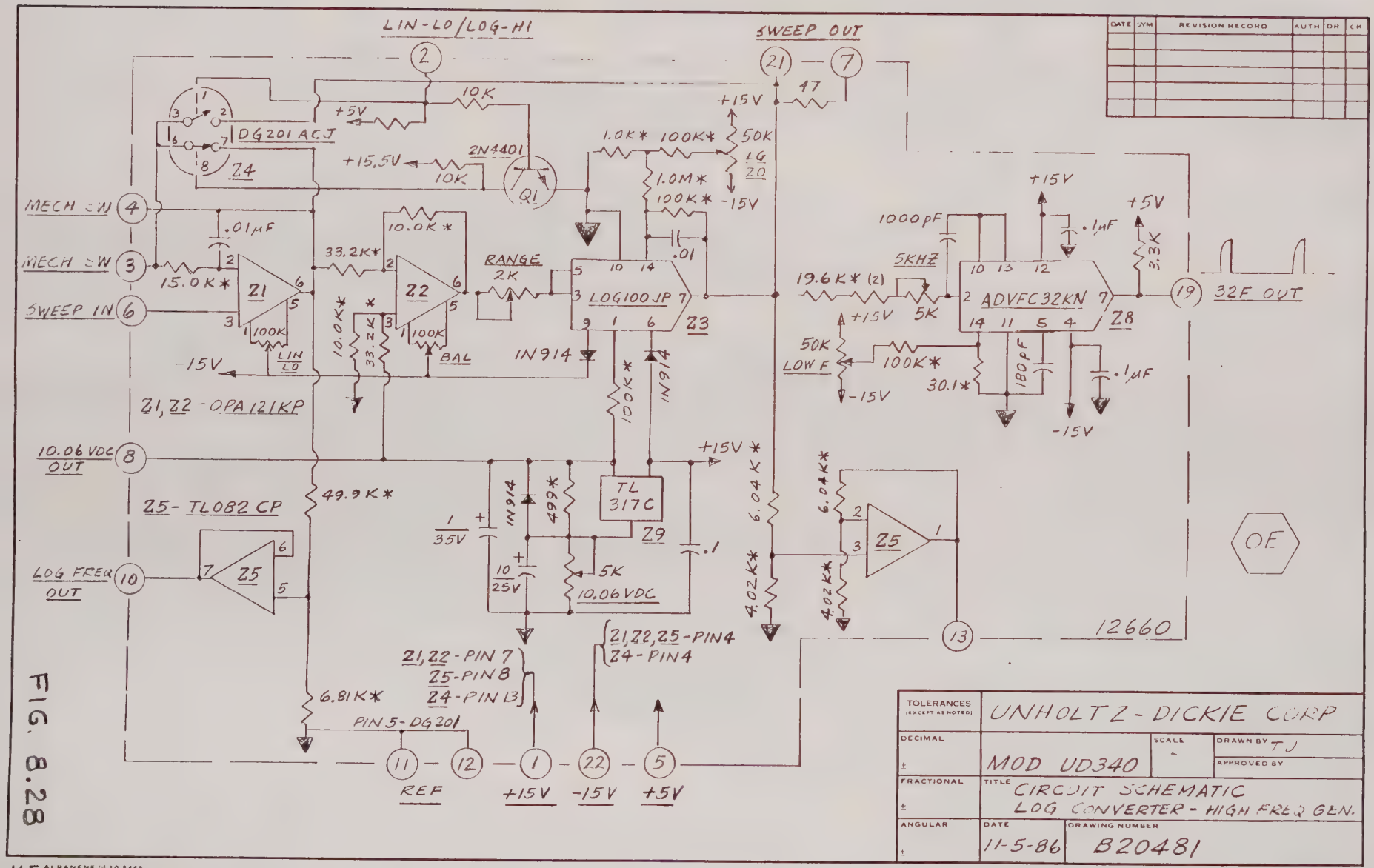
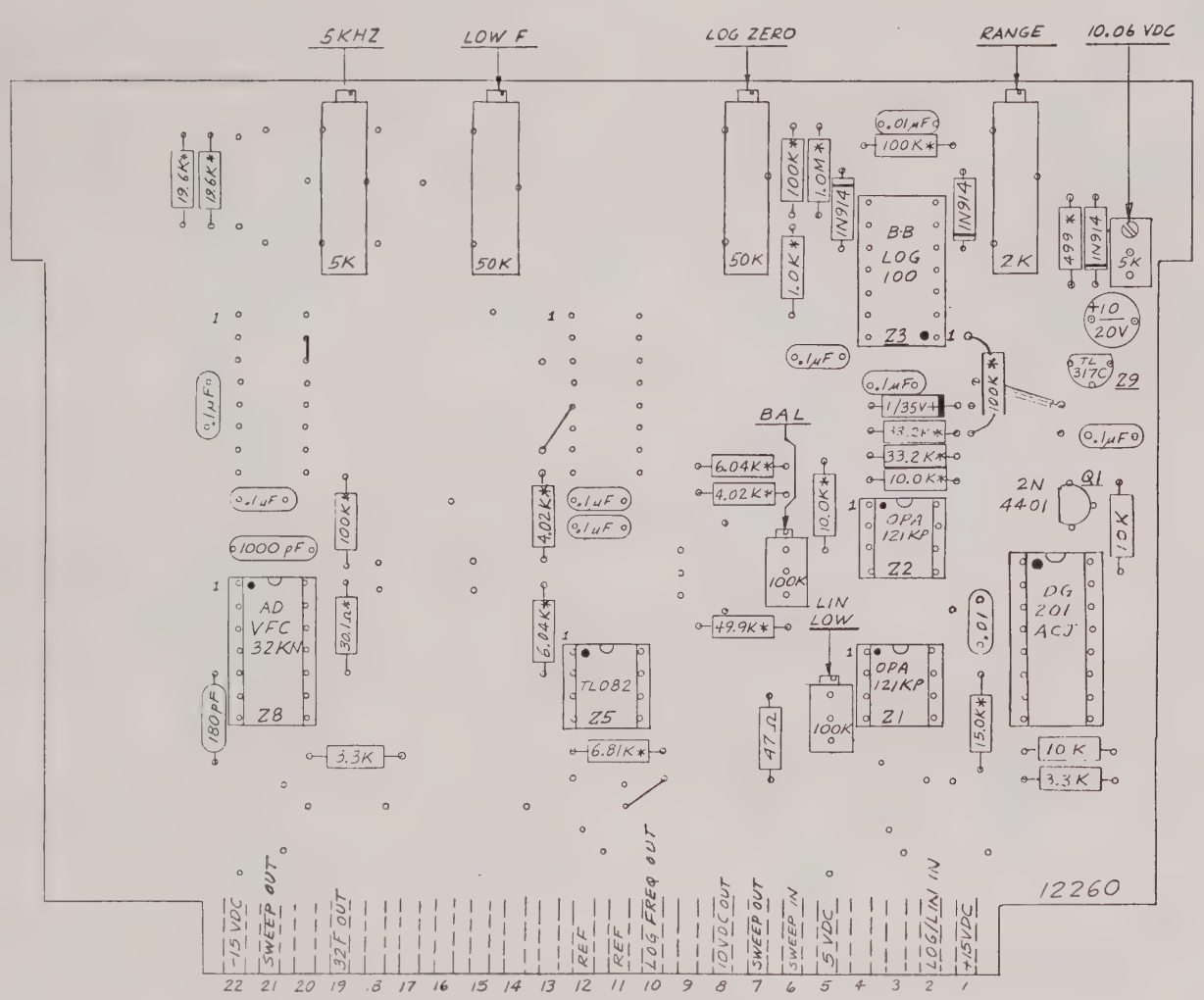


FIG. 8.28

DATE	SYM	REVISION RECORD	AUTH	DR	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	MOD UD340	SCALE -	DRAWN BY TJ / APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC LOG CONVERTER - HIGH FREQ GEN.		
ANGULAR ±	DATE 11-5-86	DRAWING NUMBER B20481	

K·E ALBANENE (914) 10 5465 ENGINEERS' STANDARD FORM
MADE IN U.S.A.


5KHZ
LOW F
LOG ZERO
RANGE
10.06 VDC
19.6K*
12.6K*
5K
50K
50K
100K*
1.0M*
1N914
0.01μF
100K*
1N914
2K
499*
1N914
5K
+10
20V
BB
LOG
100
Z3
0.1μF
0.1μF
1/35V+
100K*
TL
317C
Z9
BAL
6.04K*
4.02K*
10.0K*
33.2K*
33.2K*
10.0K*
2N
4401
Q1
OPA
121KP
Z2
0.1μF
0.1μF
0.1μF
1000 pF
100K*
4.02K*
0.1μF
0.1μF
AD
VFC
32KN
Z8
301Ω*
180PF
3.3K
TL082
Z5
6.04K*
6.81K*
100K
LIN
LOW
49.9K*
47Ω
OPA
121KP
Z1
100K
.01
15.0K*
DG
201
ACJ
10K
10K
3.3K
12260
-15 VDC
SWEEP OUT
32F OUT
REF
REF
LOG FREQ OUT
10VDC OUT
SWEEP OUT
SWEEP IN
5 VDC
LOG/LIN IN
+15VDC
22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
OE
UNHOLTZ-DICKIE CO
COMPONENT LAYOUT
LOG CONV - HF GEN.
10/28/66
320482

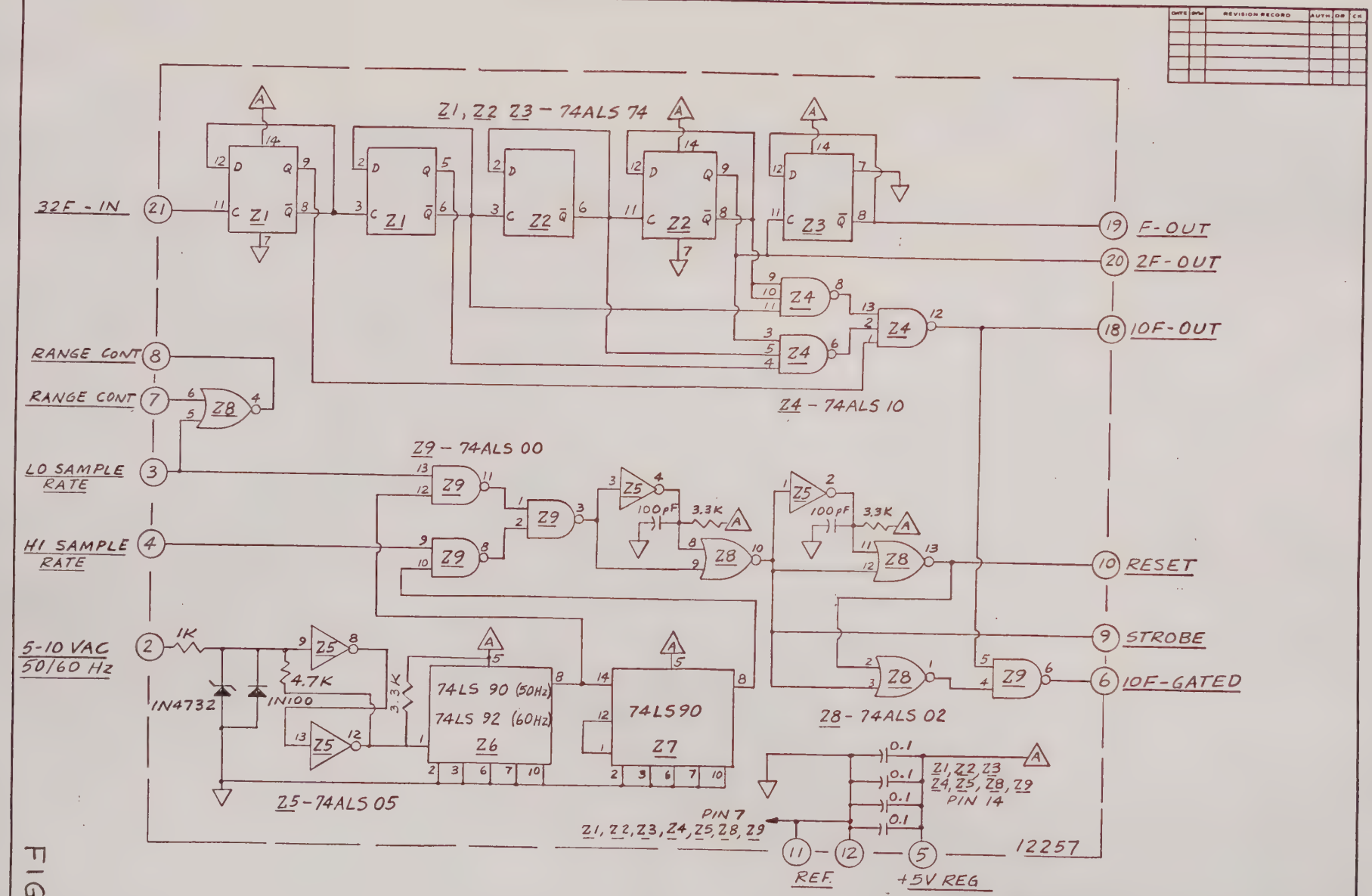


FIG. 8.30

REVISION RECORD					
DATE	DWN		AUTH	DB	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL	UD340 OSP-4 OSC-1	SCALE –	DRAWN BY TU
FRACTIONAL	TITLE CIRCUIT SCHEMATIC FREQ. DIVIDER-COUNTER CONT.		APPROVED BY
ANGULAR	DATE 12-24-86	DRAWING NUMBER C12259	

06

06
UNHOLTZ-DICKIE CORP
COMPONENT LAYOUT
COUNTER CONT.-FREQ DIV.
8 25 86
D 12258
12257
74ALS10
74ALS74
74ALS74
74ALS74
74ALS90 (50Hz)
74ALS92 (60Hz)
74ALS92
74ALS02
74ALS00
74ALS05
Z4
Z3
Z2
Z1
Z6
Z7
Z8
Z9
Z5
0.1
3.3K
3.3K
3.3K
100pF
100pF
0.1
47K
1K
IN100
IN4732
32F IN
2F OUT
F OUT
10F OUT
REF
REF
RESET
STROBE
RANGE CONT
RANGE CONT
GATED 10F
+5VDC REG.
LO SAMP. RATE
HI SAMP. RATE
5-10VAC 50/60 HZ

FIG 8.31

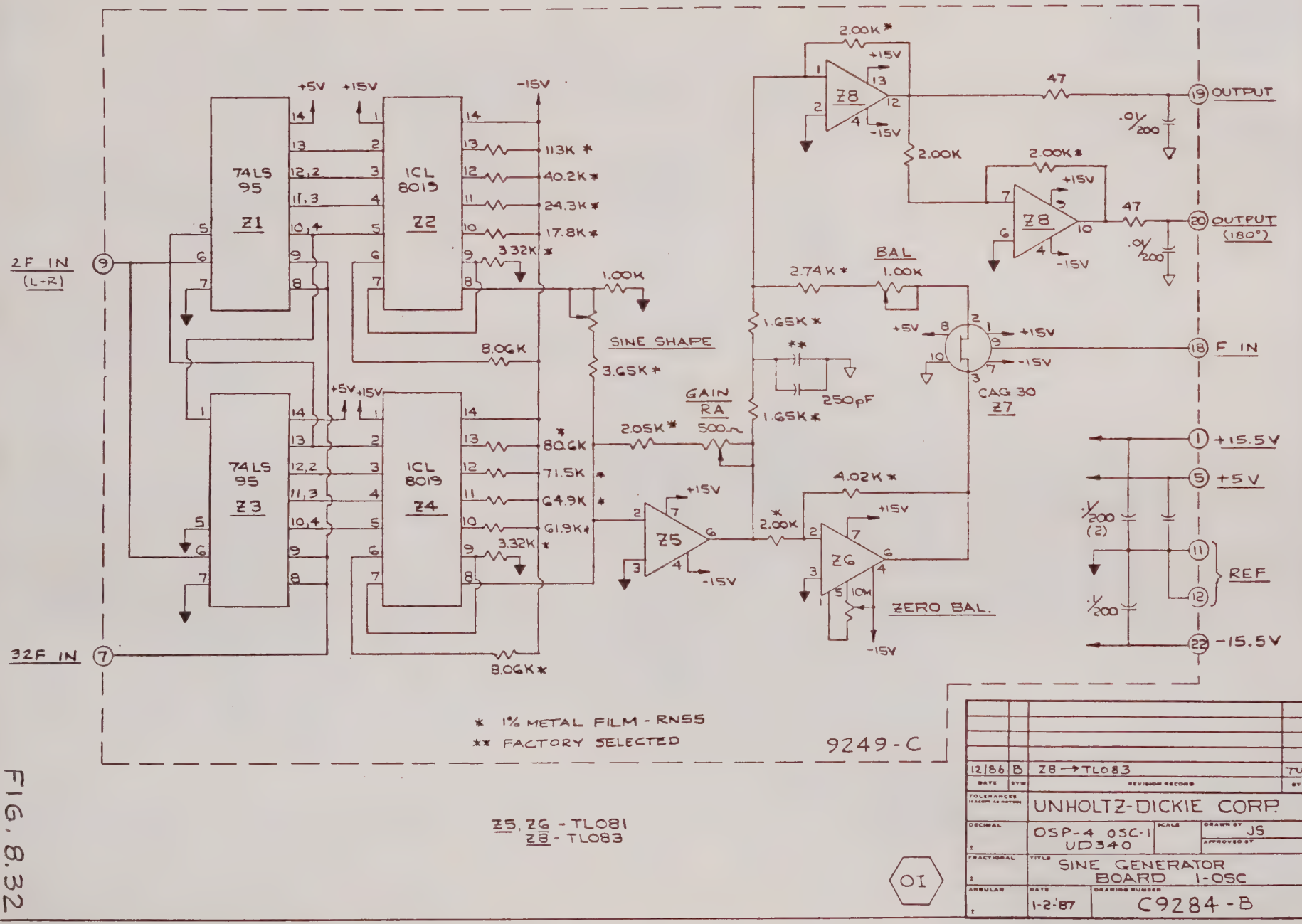
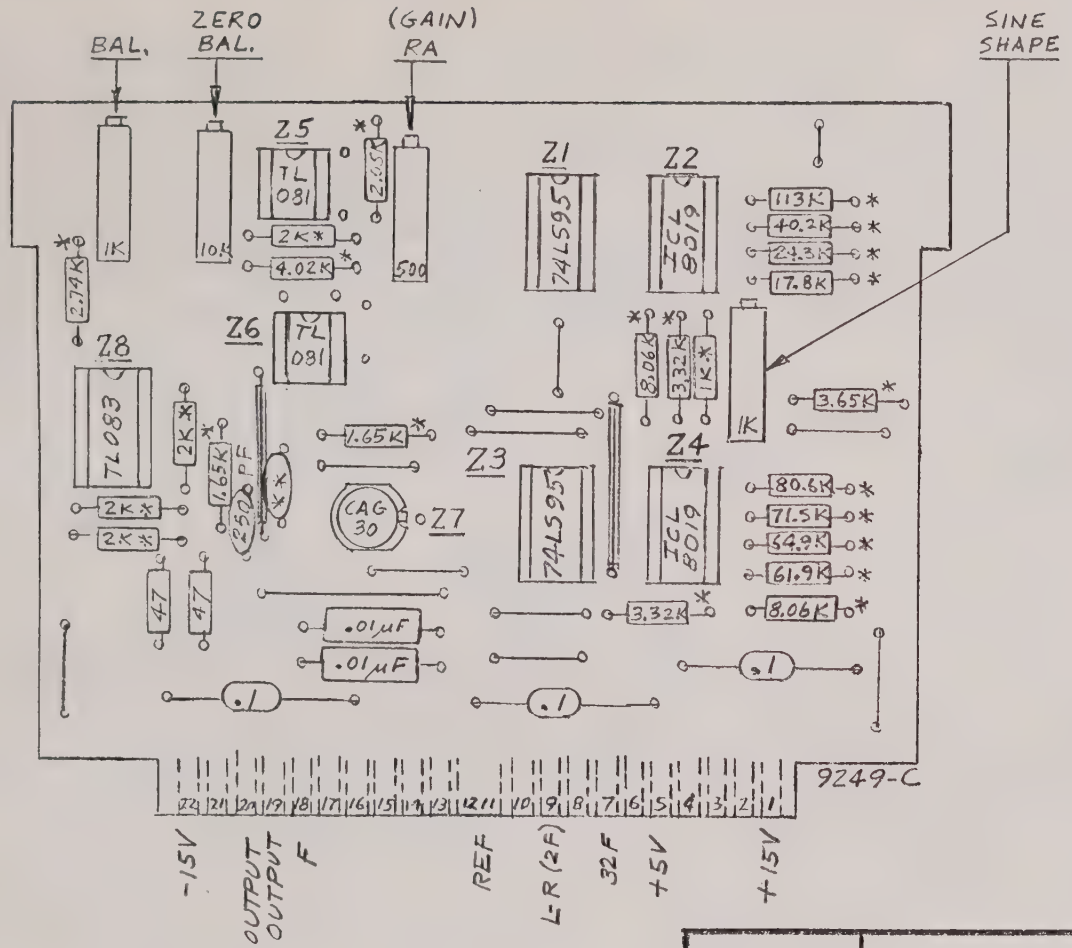

2F IN (L-R)
32F IN
74LS 95 Z1
74LS 95 Z3
ICL 8019 Z2
ICL 8019 Z4
+5V
+15V
-15V
113K *
40.2K *
24.3K *
17.8K *
3.32K *
1.00K
8.06K
SINE SHAPE
3.65K *
GAIN
RA
500Ω
2.05K *
80.6K *
71.5K *
64.9K *
61.9K *
3.32K *
8.06K *
Z5
Z6
Z8
2.00K *
47
OUTPUT
.01/200
2.00K
OUTPUT (180°)
BAL
1.00K
2.74K *
1.65K *
**
250pF
CAG 30
Z7
F IN
+15.5V
+5V
.1/200 (2)
REF
-15.5V
4.02K *
2.00K *
ZERO BAL.
10M
* 1% METAL FILM - RN55
** FACTORY SELECTED
9249-C
Z5, Z6 - TL081
Z8 - TL083
12/86 B Z8 → TL083 TU
UNHOLTZ-DICKIE CORP.
OSP-4 OSC-1
UD340
SCALE
DRAWN BY JS
APPROVED BY
SINE GENERATOR BOARD 1-OSC
DATE 1-2-87
C9284-B
OI

FIG. 8.32

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
5-75	A	BOARD SIZE CHGD	TU		
8-85	B	531 → TL081	TU		
12-86	C	MA747 → TL083	TU		
		7495 → 74LS95	TU		
		PS RES-REM.			



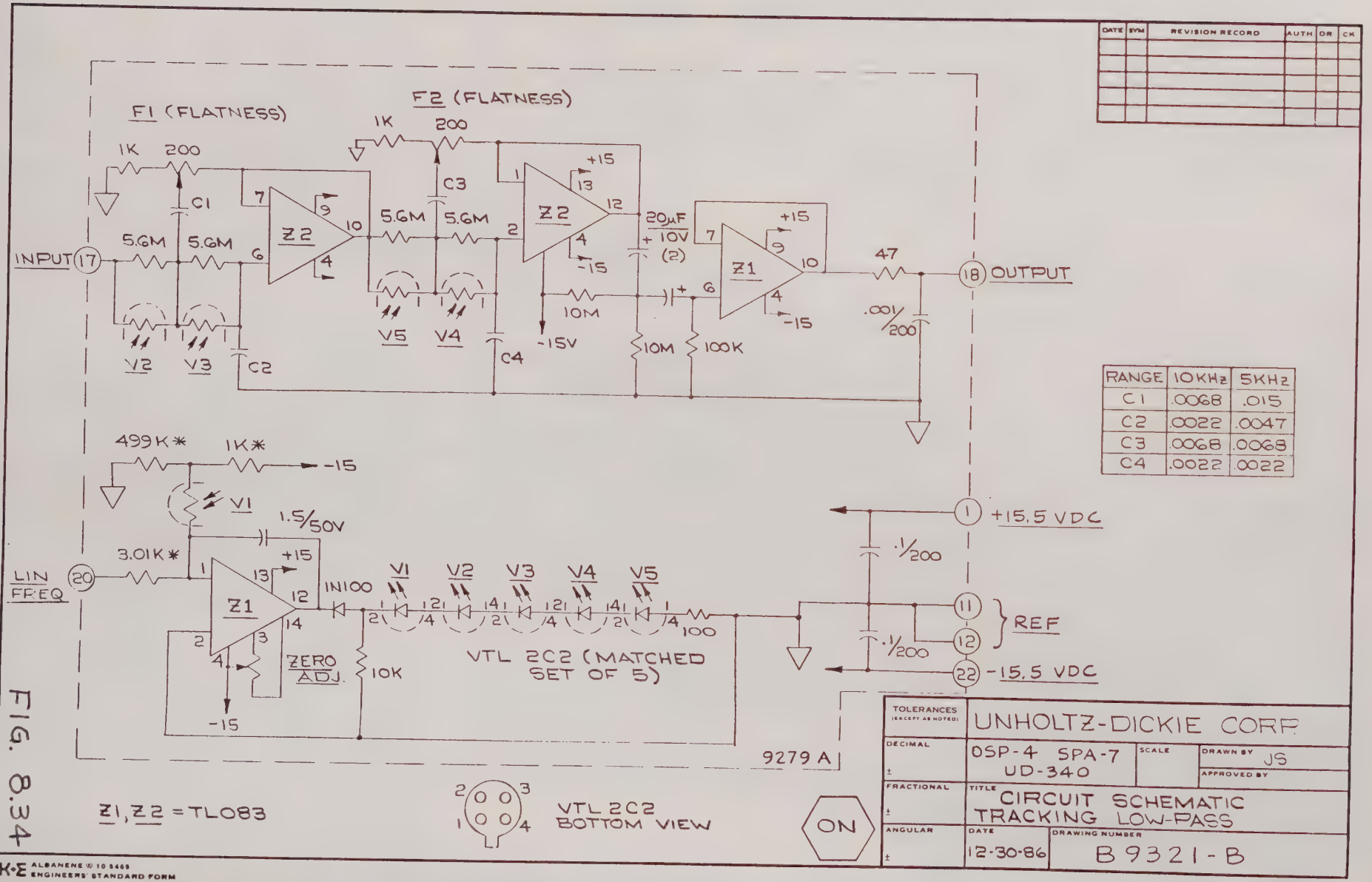
01

FIG. 8.33

* 1% METAL FILM
** CAP. VALUE ADJUSTED AT FACTORY

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±		SCALE	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT SINE GENERATOR		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER A9286 C	

K&E CRYSTALENE @ 10 5465 ENGINEERS STANDARD FORM
MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH	DR	CK

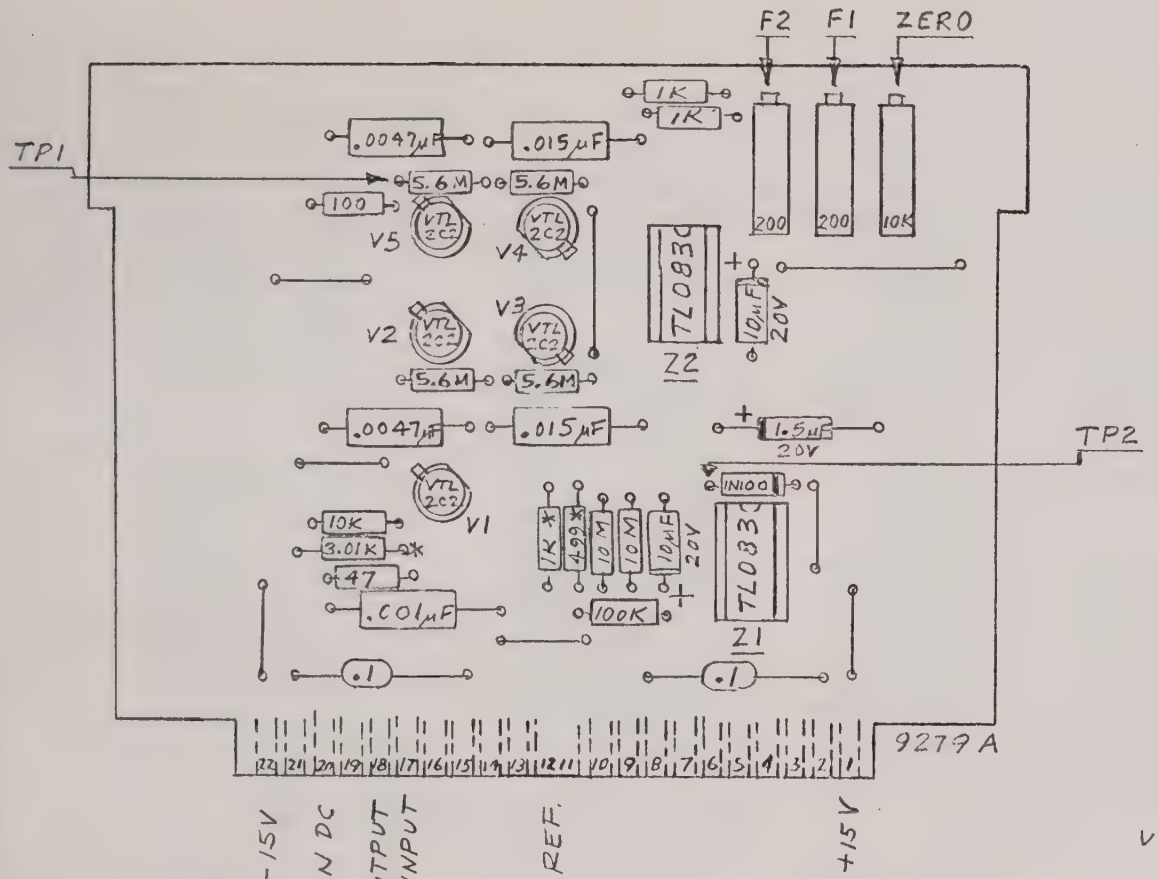
RANGE	10KHz	5KHz
C1	.0068	.015
C2	.0022	.0047
C3	.0068	.0068
C4	.0022	.0022

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.
DECIMAL ±	OSP-4 SPA-7 UD-340
SCALE	
DRAWN BY	JS
APPROVED BY	
FRACTIONAL ±	TITLE: CIRCUIT SCHEMATIC TRACKING LOW-PASS
ANGULAR ±	DATE: 12-30-86
DRAWING NUMBER	B 9321-B

FIG. 8.34

K+E ALBANENE ® 10 8468 ENGINEERS' STANDARD FORM
MADE IN U.S.A.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
5-75	A	BOARD SIZE CHGD	TU		
6-75	B	(9) 2.2M ⇒ 5.6M	TU		
3-78	C	μA747 ⇒ TL083	TU		
12-86	D	PS RES REM'D	TU		



ON

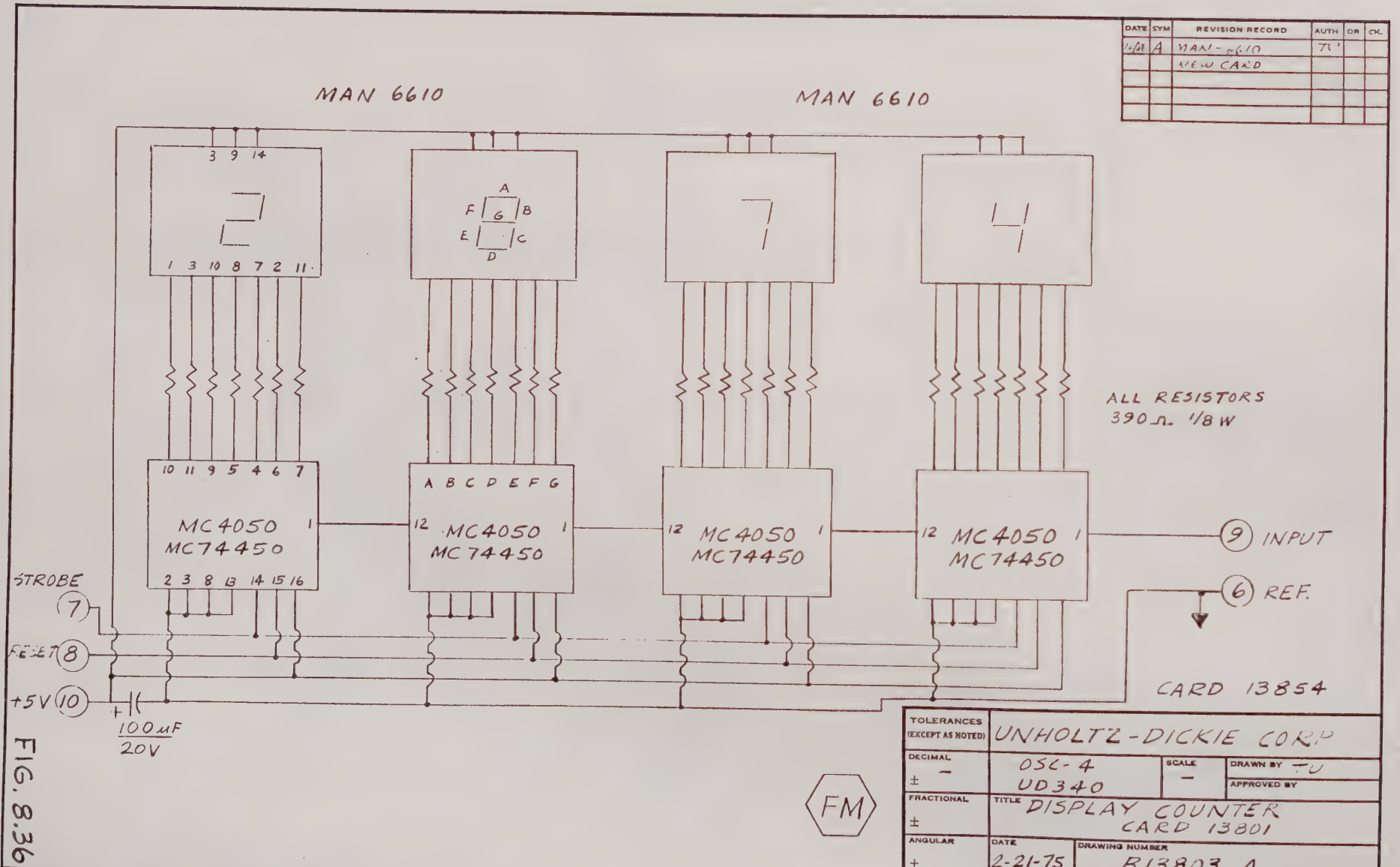
VTL 2C2 - MATCHED SET

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT TRACKING LO-PASS		
ANGULAR ±	DATE 12-18-86	DRAWING NUMBER A9322 D	

FIG. 8.35

K&E CRYSTALENE ® 10 5465 ENGINEERS' STANDARD FORM

MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH	DR	CK.
1/[illegible]	A	MAN-6610 NEW CARD	TJ		

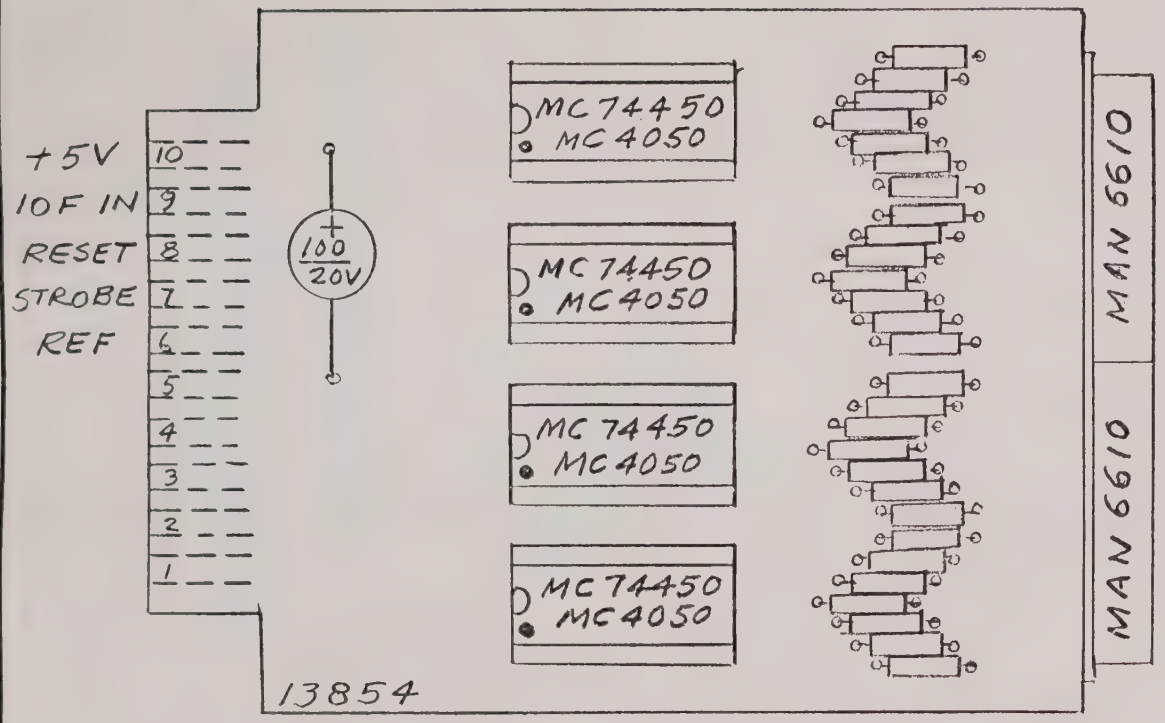
TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ± —	OSC-4 UD340	SCALE —	DRAWN BY TJ / APPROVED BY
FRACTIONAL ±	TITLE DISPLAY COUNTER CARD 13801		
ANGULAR ±	DATE 2-21-75	DRAWING NUMBER B13803 A	

FIG. 8.36

K&E ALBANENE 10 5465 ENGINEERS' STANDARD FORM
MADE IN U. S. A.

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.

RESISTORS
390Ω 1/8W



MOUNTED AT
RIGHT ANGLES

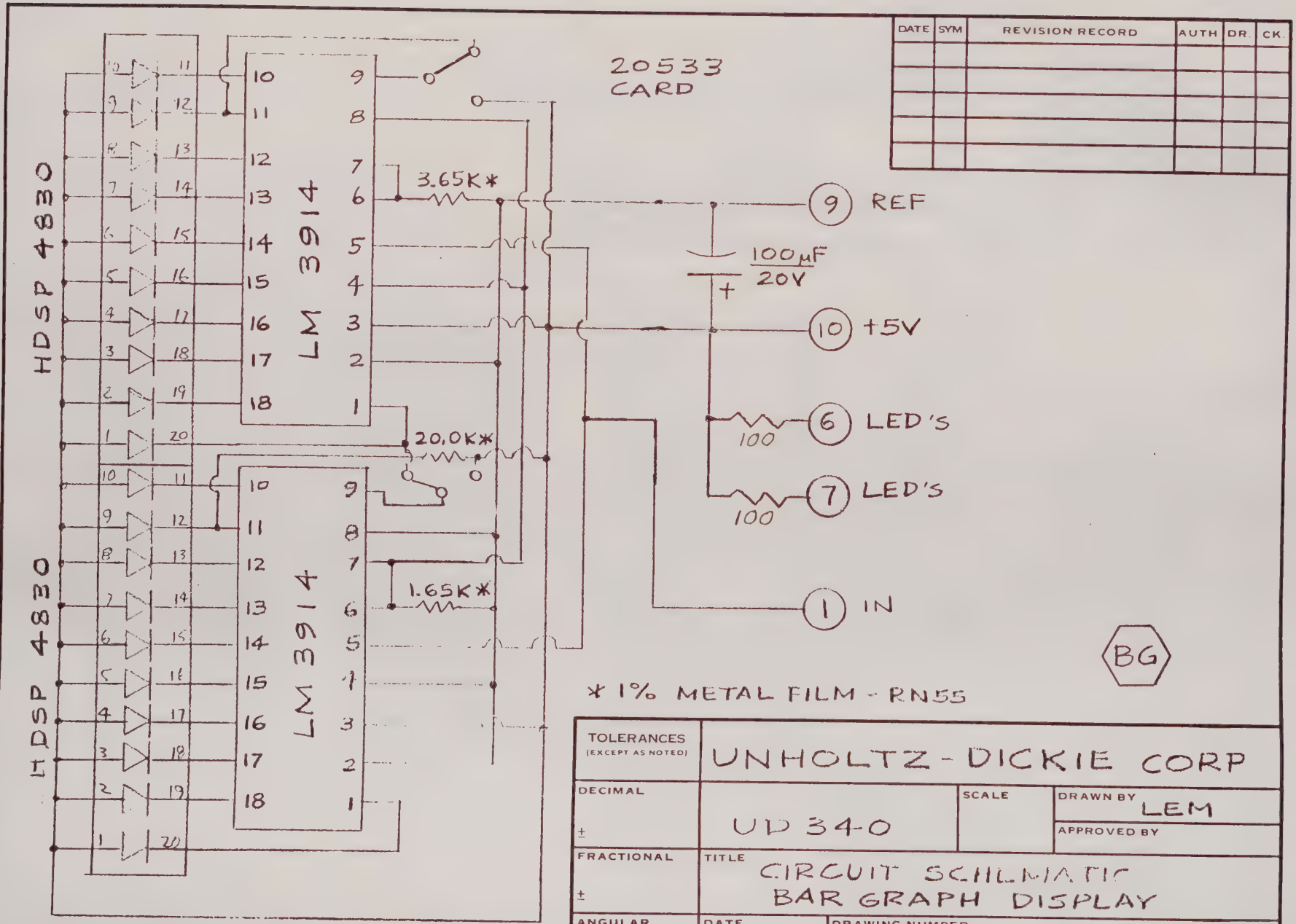
FIG. 8.37

FM

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	OSP-4 UD340	SCALE	DRAWN BY TU APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT FREQUENCY METER		
ANGULAR ±	DATE 12-22-86	DRAWING NUMBER A 13880	

K·E ALBANENE ® 10 5465
ENGINEERS' STANDARD FORM

MADE IN U.S.A.

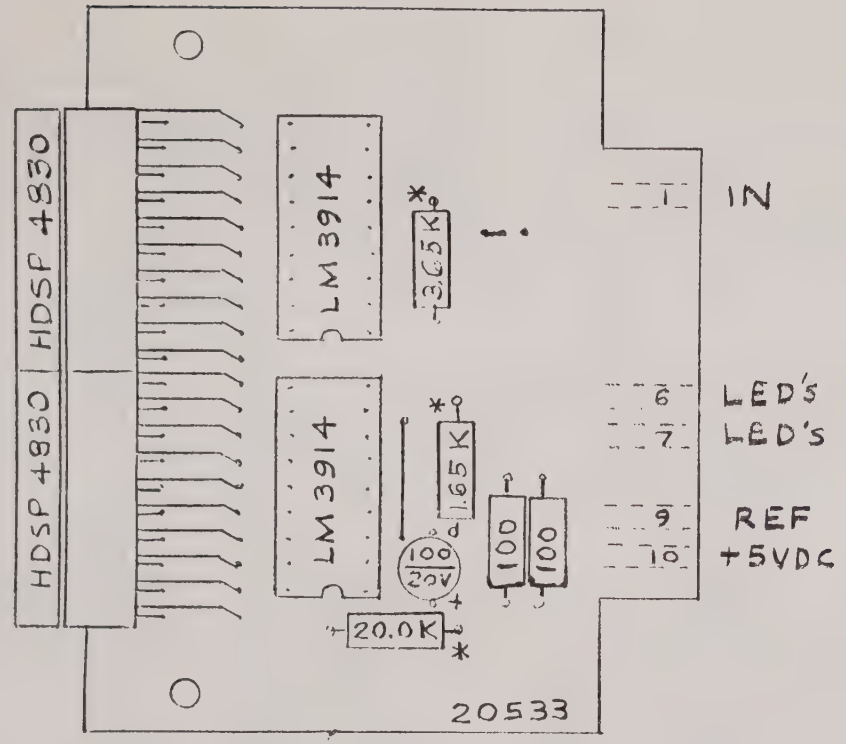


DATE	SYM	REVISION RECORD	AUTH	DR.	CK

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD 34-0	SCALE	DRAWN BY LEM
			APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC BAR GRAPH DISPLAY		
ANGULAR ±	DATE 1-27-87	DRAWING NUMBER A19122	

FIG. 8.38

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.



BG

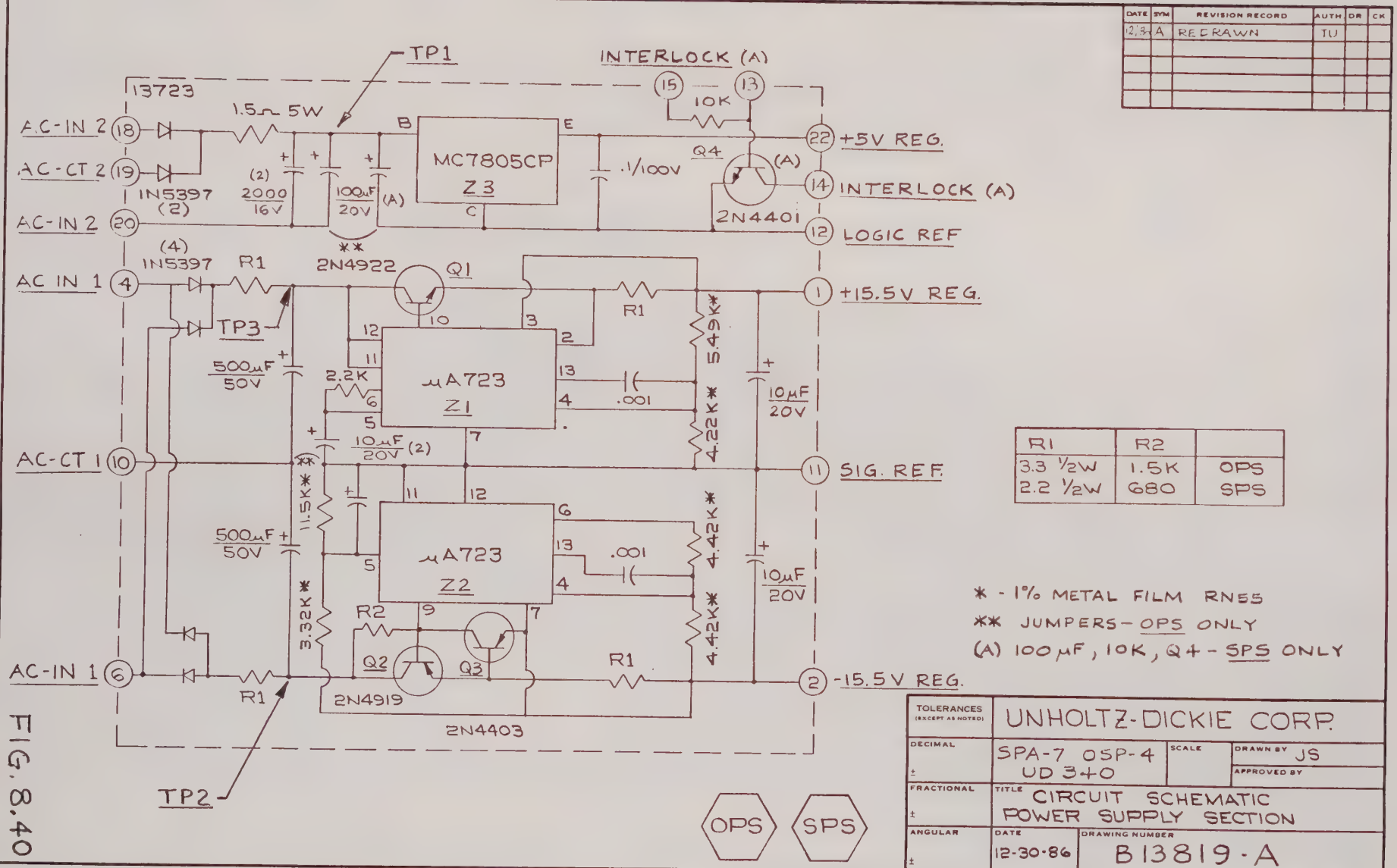
* 1% METAL FILM RN55

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP		
DECIMAL ±	UD340	SCALE	DRAWN BY LM APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT BAR GRAPH DISPLAY		
ANGULAR ±	DATE 1-21-87	DRAWING NUMBER A 20534	

FIG. 8.39

K·E ALBANENE ® 10 5465
ENGINEERS' STANDARD FORM

MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH	DR	CK
12/3	A	REDRAWN	TU		

R1	R2	
3.3 ½W	1.5K	OPS
2.2 ½W	680	SPS

* - 1% METAL FILM RN55

** JUMPERS - OPS ONLY

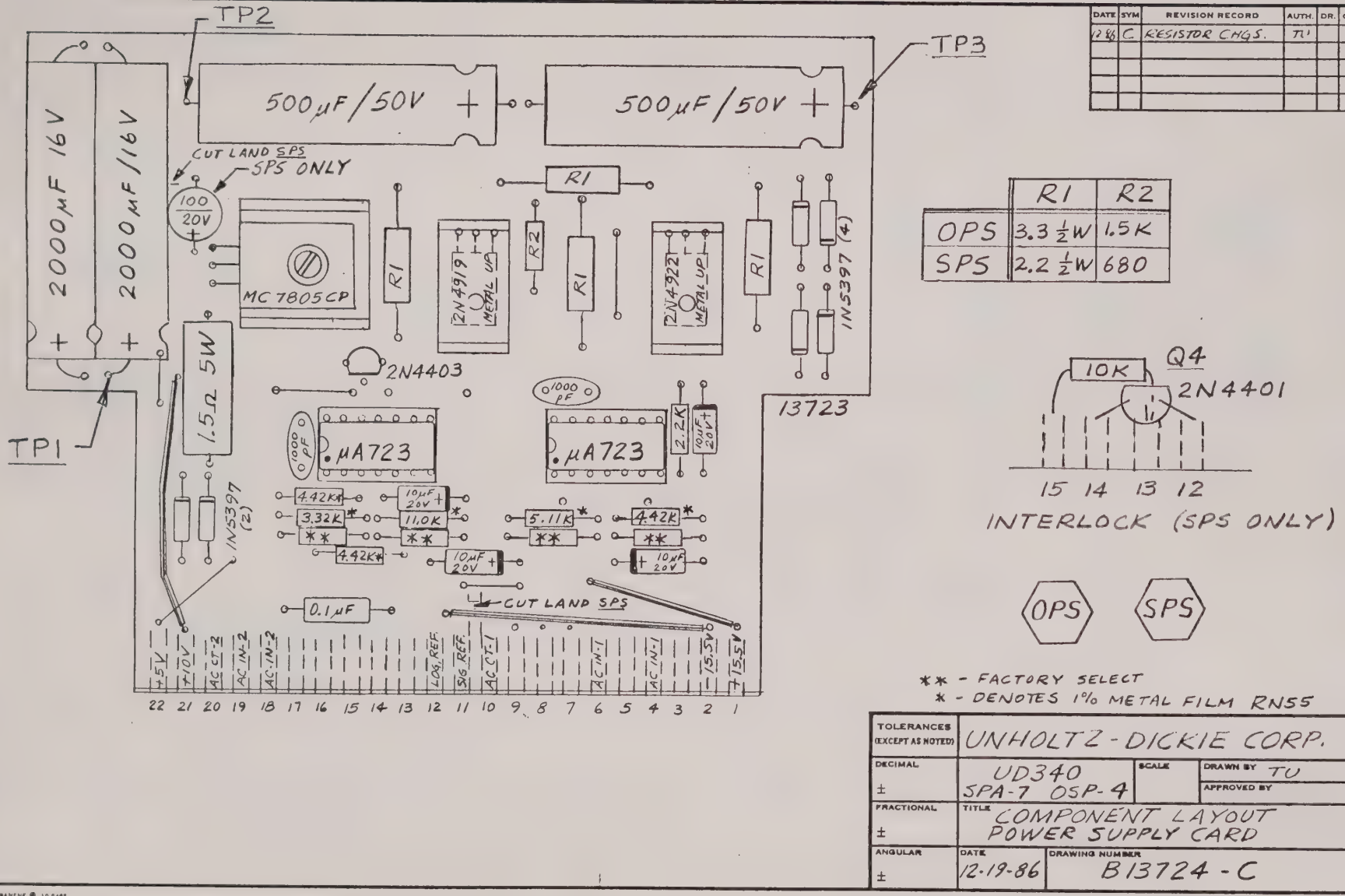
(A) 100µF, 10K, Q4 - SPS ONLY

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	SPA-7 OSP-4 UD 340	SCALE	DRAWN BY JS
			APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC POWER SUPPLY SECTION		
ANGULAR ±	DATE 12-30-86	DRAWING NUMBER B13819-A	

FIG. 8.40

K·E ALBANENE © 10 8485 ENGINEERS' STANDARD FORM

MADE IN U.S.A.



DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
12/86	C	RESISTOR CHGS.	TU		

	R1	R2
OPS	3.3 ½W	1.5K
SPS	2.2 ½W	680

INTERLOCK (SPS ONLY)

OPS SPS

** - FACTORY SELECT
* - DENOTES 1% METAL FILM RN55

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD340 SPA-7 OSP-4	SCALE	DRAWN BY TU / APPROVED BY
FRACTIONAL ±	TITLE COMPONENT LAYOUT POWER SUPPLY CARD		
ANGULAR ±	DATE 12-19-86	DRAWING NUMBER B13724-C	

FIG. 8.41

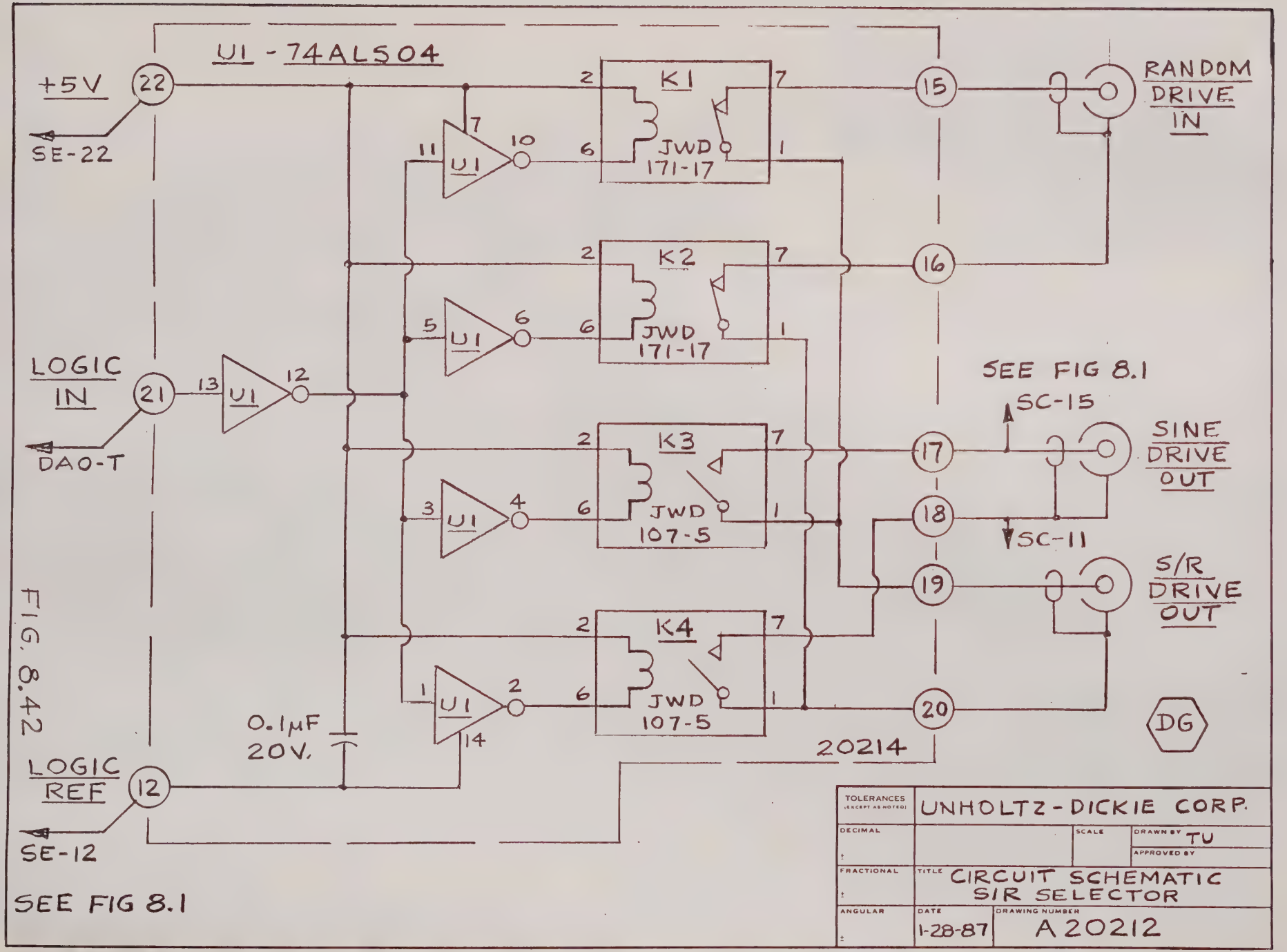


FIG. 8.42

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±		SCALE	DRAWN BY TU
			APPROVED BY
FRACTIONAL ±	TITLE CIRCUIT SCHEMATIC S/R SELECTOR		
ANGULAR ±	DATE 1-28-87	DRAWING NUMBER A 20212	

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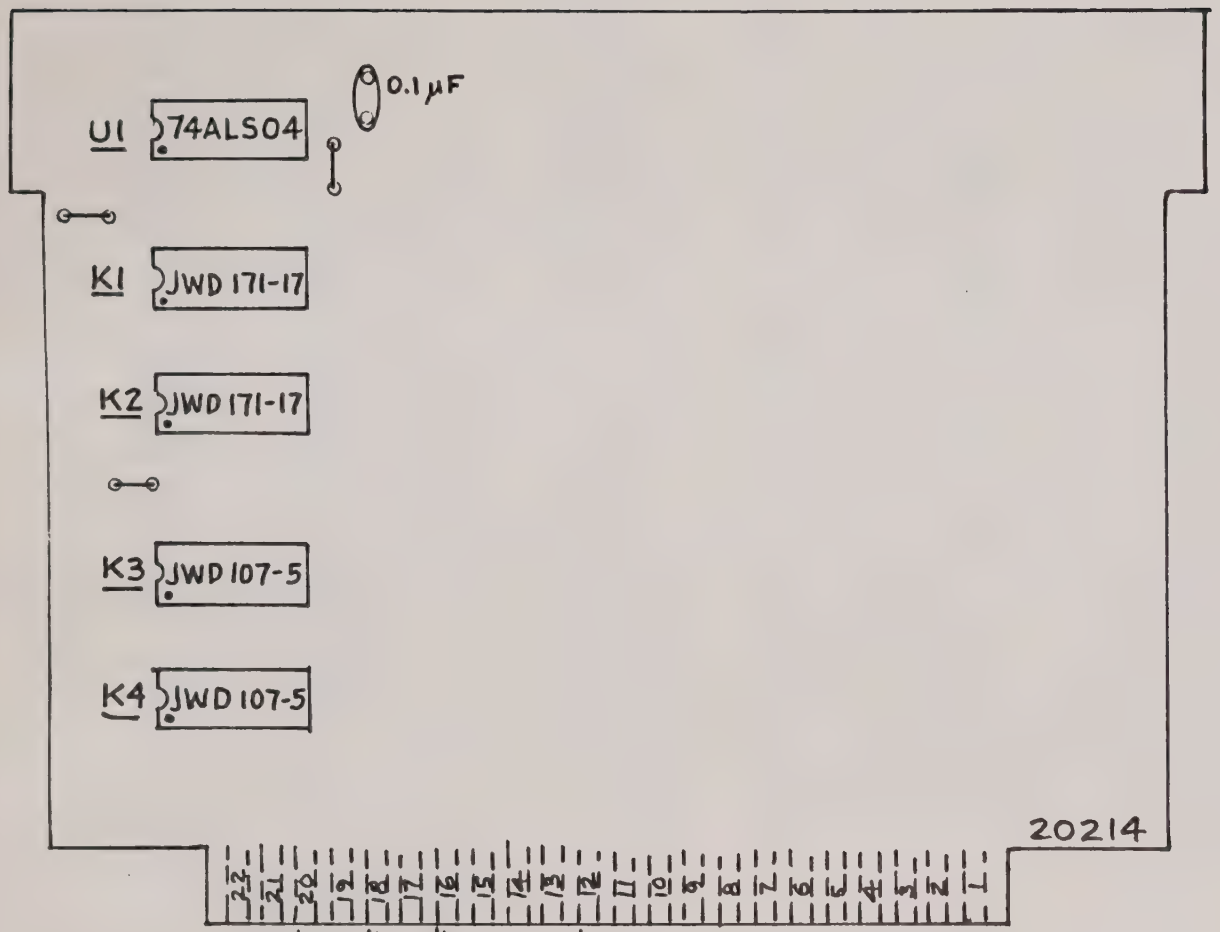

DG

TOLERANCES (EXCEPT AS NOTED)	UNHOLTZ-DICKIE CORP.		
DECIMAL ±	UD 340	SCALE	DRAWN BY / APPROVED BY
FRACTIONAL ±	TITLE: COMPONENT LAYOUT S/R SELECTOR		
ANGULAR ±	DATE: 11/27/87	DRAWING NUMBER: A20213	

FIG. 8.43

K-E ALBANENE INC 10 5463 ENGINEERS STANDARD FORM

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9. CIRCUIT DESCRIPTION

The operation and signal flow of the UD340 is briefly described in Sections 1.2 and 1.3. The circuit card connection schematic is found in Fig. 8.1 and detailed circuit diagrams/layouts for each card are found in Figs. 8.2 through 8.43. The function of each card is briefly described in this chapter.

9.1 DAS-DAO - Interface - As the name implies, this card provides interface buffers, latches, logic, CMOS range switches, and MDAC's between the DASCON 1 card and the analog circuits of the UD340. U1 selects the control variable (A,V,D), U3 provides decade range switching of the control signal for the meter and control circuitry and U6 provides the fine gain adjustment for the control signal. The associated latches provide the switching necessary to establish the desired program segments.

Range switching for Servo Speed control is provided by U31. The fine gain control for determining sweep time/sweep speed is provided by U28.

Other functions such as mode control are provided by digital signals.

9.2 DB - Eight Channel Multiplexer - provides the multiplexer U13 and the memory U3 for proper sequencing of the eight possible input signals for average control. A 5-30 Hz bandpass filter (U5, U9) is included for processing low-level (<1g - pk), low frequency (<30 Hz) signals (single channel control) for display purposes.

9.3 DC - Eight Channel Monitor - provides the switch U13 for selecting the monitor channel given by keyboard command. A bandpass filter identical to that on the DB card is also provided by U5 and U9.

9.4 DD - Tri AC-DC Converter - contains three identical channels of AC-DC converters with three-pole filtering (U2,U6 - U3,U7 - U4,U8), each preceded by a controlled CMOS range-switch (U11 - U13 - U14). Each input is fed by the acceleration control signal and the active range of each is

Channel 1	<1g, <30 Hz		<10g, <30 Hz
Channel 2	1g to 10g	OR	10g to 100g
Channel 3	10g To 100g		100g to 1000 g

The selection of either set of choices above is determined by the maximum acceleration value in the Test Setup. The selection of the DC output provided by switch U12 follows the level table above and allows maximum accuracy for displaying vibration levels on the Video Monitor.

9.5 DE - Tri AC-DC Converter - provides exactly the same function as DD but the input signal is the acceleration signal for the monitor channel.

9.6 SA - Charge Amplifier - Integrators - contains the charge converter, Z2, the input sensitivity normalizer and three-pole low pass filter, Z3. The velocity and displacement integrators for the control signal are Z5 and Z7.

9.7 SB - AGC Control Card - contains a two-pole tracking high-pass filter (Z9 and Z1) which is controlled by the LIN FREQ signal, and is used to filter the velocity and displacement control signals from SA. The -3dB frequency is approximately 1/3 the operating frequency and the response is unity at the operating frequency. The low frequency noise is greatly reduced and makes possible the control of low velocities and displacements at high frequencies without stability problems.

The vibration control signal is full wave rectified and compared to the reference (Z3, Z4). The LOG FREQ signal is used to control the resistance of two EVR's (V5, V7). The first, V5, is used as a prefilter to prevent drive signal distortion under closed-loop conditions. The second, V7, determines the servo speed and the closed-loop time constant directly (See 7.11.3, 7.13.3). Switches Z7 and Z8 provide control for the AUTO/MAN, ABORT and LOCAL modes.

9.8 SC - AGC Amplifier - contains the integrator Z3, which accepts the drive current from SB-V7. The integrator output voltages controls the gain of the AGC amplifier (Z8, Z4, Z3). Gain in dB is a linear function of the integrator output voltage. The temperature of Z8 is controlled by Z7 for amplitude stability.

The amplifier (Z1, Z2) accepting the oscillator section output predistorts this signal at the input to the AGC amplifier so that the output of Z3 has extremely low distortion.

Switches (Z6) provide mode control.

9.9 DF - Local/Keyboard/Meter - provides AC-DC conversion and three pole filtering (U7) of the control signal for input to the Digital Vibration Meter VM, processes the LOG FREQ signal through U6 to feed to the DASCON 1 card, provides an AC to RMS DC conversion with two-pole filtering (U2) of the drive voltage to feed to the DASCON 1 card, provides a logarithmic output for the DRIVE VOLTAGE (dB) bar indicator, and provides switching functions for the LOCAL and KEYBOARD Modes (U3, U4, U5).

9.10 SE - Mode Control - contains logic and flip-flops necessary to control the CMOS switches on other cards and to operate the mode indicator LED's.

9.11 OS Oscillator Mode Control - contains logic, flip-flops, and CMOS switches necessary for accepting logic inputs and providing means for sweeping the oscillator, holding the frequency constant, manually controlling the frequency, and resetting the frequency to the upper or lower limit.

9.12 OA - Sweep Light Control - contains the flip-flop for HOLD mode control and drivers for the UP, DOWN and HOLD LED's.

9.13 OC - Sweep Speed Control - generates a symmetrical square wave drive current. The magnitude of the drive current is determined by the MDAC-controlled amplifier on DAS-DAO, and is the correct value for providing the sweep time/speed specified in the test setup. A logic signal applied to Z3 reverses the drive current.

9.14 OD - Sweep Generator - accepts the drive current from OC and integrates it (Z1) to produce a symmetrical triangular wave voltage at OD-15. The upper and lower limit comparators (Z2, Z3) are used to reverse the sweep direction, as does the logic signal from the REVERSE flip-flop Z4.

9.15 OE - Log Converter - High Frequency Generator - actually contains an anti-log converter, Z3, which produces the log-sweep at OE-21. CMOS switch, Z4, provides selective feedback to provide both logarithmic and linear sweeps at OE-21. Regulator Z9 provides a precision 10.06 V reference source for the circuit.

The high frequency generator, Z8, is a precision V-F converter controlled by the sweep voltage at OE-21. Pulses at 32 times the operating frequency (32F) are produced at OE-19.

9.16 OG - Frequency Divider - Counter Control - receives the 32F pulse train from OE and provides 2F and 1F square waves for the OI card. The 32F train is also divided into an irregularly spaced 10F pulse train which is used to provide the frequency display on FM (Z1, Z2, Z3, Z4).

Control for the frequency meter (FM) is also provided. The power frequency is divided by Z5, Z6 and Z7 to provide a gate of 0.1 second to count the 10F pulses. Z5, Z8, and Z9 also provide strobing and resetting action.

9.17 OI - Sine Generator - contains an eight-bit reversible shift register (Z1, Z3), eight current switches (Z2, Z4), and a signal inverter (Z5, Z6) to produce a stairstep sine wave at OI-19.

The shift register shifts at the 32F rate. The reversing of the direction of the shift register is controlled by the 2F signal, each direction producing 90° (one quarter) of the sine wave signal. The 1F square wave provides the signal inversion through Z7 necessary to provide the negative portion of the sine wave.

Harmonic distortion is approximately 4% with mostly 31st and 33rd harmonics.

9.18 ON - Tracking Low-Pass Filter - filters the high frequency harmonics at the output of OI. Two separate two-pole filters are provided. The variable cutoff frequency is produced by using matched EVR's (V1 through V5). The EVR's are controlled by the LIN FREQ input (ON-20) for resistance inversely proportional to frequency.

9.19 DG - S/R Selector - is controlled by a logic signal to select the RANDOM DRIVE OUT signal from the UD320 (Random Testing) or the SINE DRIVE OUT signal from the UD340 (Sine Testing) and route the selected signal to the S/R DRIVE OUT connector on the UD340. The RANDOM DRIVE OUT signal is selected if the AC power to the UD340 is off. This selection is necessary in systems with both Random and Sine Vibration Contollers (UD340 and UD320).

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